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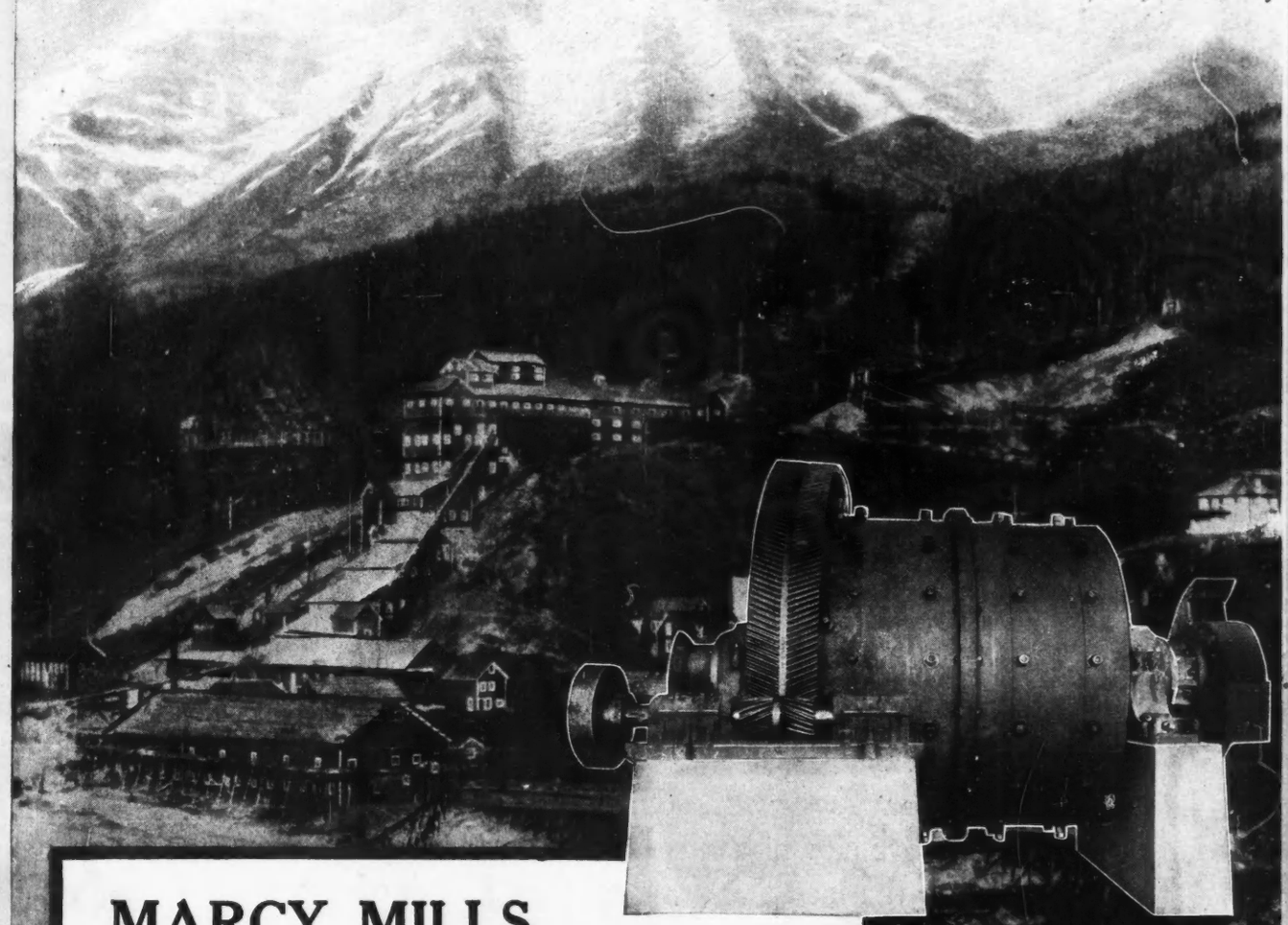

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Volume 108 — New York, Saturday, July 5, 1919 — *Number* 1

A Few Words About Ourselves

WITH the opening of its 108th volume the *Journal* appears in a new editorial garb. If there were nothing more than mere caprice or whim in determining the typographical style and make-up of a modern magazine, the matter would not be worth the reader's attention; but if, as happens in this case, the changes are the result of deliberate study of the *Journal's* editorial purpose and the best mechanical means of accomplishing it, they may be worth passing comment. For ourselves, we look upon the new garb as the outward and visible sign of an inner zeal in the welfare of the mining industry, and a determination to promote its interests in a very definite way. The extent to which we achieve this declared purpose will be measured by our readers' approval. Success can come only through service.

The first and most noticeable change to attract the reader's attention is the shift of the editorial pages from their former position to the front of the book. In homely phrase, this enables the editors to greet the reader at the front door of what they hope will prove for him each week a storehouse of appropriate knowledge and information; and if, in addition, he finds therein material that affords him pleasure and recreation, the result will be doubly gratifying.

In the typographical style and arrangement of the contents of the magazine, consideration has been given to those rules and dicta that have been developed from the concrete experience of the printing craft, and a definite effort has been made to produce a prospect pleasing to the eye. In this respect, thoughtful typography serves a purpose in reaching the reader's mind similar to that of bright silver and snowy linen in tempting the diner's appetite. In the interest of certainty regarding our market quotations, we have set these in larger type, so that there will be no confusion in the integers or fractions, particularly the latter, when occasionally an accident mars the type face and gives a poor imprint. The *Journal's* market quotations are prepared with too much care to permit poor printing to vitiate their usefulness or leave room for doubt as to their exact meaning.

Close personal contact with the mining industry is an essential part of the *Journal's* editorial policy, to be accomplished by frequent and regular visits into the field by members of the editorial staff. In this respect the importance of the Rocky Mountain and Pacific Coast region has been specially recognized by the establishment of a Western editorial office in San Francisco, in conjunction with other McGraw-Hill engineering publications. The *Journal* will be represented there by a Western Editor, who by travel, correspondence and participation in local affairs will be able to reflect adequately the activities of a great mining region; but what perhaps is of greater importance, he will at the same time personalize the *Journal's* service and usefulness to those who are engaged in mining. Thus, not only will the West find expression in the *Journal*, but the latter, as the exponent of the industry, will function most effectively in Western mining affairs. We shall be pleased if members of the fraternity will accept our cordial invitation to make personal use of this San Francisco office. It is established for the convenience of our readers and others engaged in the mining industry, and may be used as their personal headquarters, for the receipt of mail, or for conference with the Western Editor when he can be of assistance.

But the *Journal* has a still larger field of usefulness in reflecting world-wide mining conditions. It has become a trite saying that the war created new relations in our industrial life, but it is none the less true. Certain it is that the war demonstrated as nothing else could the far-reaching importance of the mining industry, the apparent dependence of the world on the peculiar mineral resources of certain countries, and the necessity for every nation to know its neighbors' resources as well as to survey carefully its own. Accordingly, we in the United States face the necessity of extending our horizon and adjusting our concepts of the mining industry. Henceforth we must think internationally as well as nationally, and view the world as the field of action for American mining engineers. No longer will it suffice to be well posted on conditions in the United States alone. We must be prepared to seek opportunities elsewhere for the investment of American mining capital, and we must view domestic enterprises in the light of possible foreign competition. In the reflection of these new conditions the *Journal* will draw upon authentic and reliable sources of information.

The publication of a magazine is a co-operative enterprise in which the reader, the advertiser and the publisher share the benefits. Contributing mainly to the reader's interest, and through him to the advertiser's, is the editorial staff, on which all concerned rely for the production of a magazine of reliability and unquestioned integrity. In the case of an engineering magazine the character of the editorial staff becomes of primary importance on account of the technical nature of the subject, requiring special knowledge and sound judgment. Manifestly, the requisite qualifications cannot reside in an individual; hence the *Journal* is the joint product of a staff of trained and experienced engineers, working as a unit for a common purpose. In this respect we have similarity with a college faculty, composed of specialists and combining a variety of talents. This makes for breadth of view and sympathy, and catholicity of judgment that appeals to a wide circle of readers. Conversely, it avoids the pitfalls of prejudice and narrow-mindedness.

The *Journal* is naturally restricted as to the subjects to which it can devote its pages, but the staff will

endeavor to take a broad view of the economics and practice of mining, mining geology, and appropriate phases of ore-treatment, continuing to rely on the valued support of old contributors and inviting the co-operation of new ones.

The Signing of the Peace Terms

A FRIEND of ours related the following incident, which we will tell in his own words: "During the war I had been in the habit of buying my evening paper at a little news-stand close to my apartment. The owner of the news-stand was a gruff, morose old fellow, who shuffled up and gave me my paper with little regard for my greeting or for custom. He was evidently German born. Last Saturday evening, however, as I entered the place, I was greeted with a cheery hello and a smile which was evidently sincere. Puzzled, I walked away, opening my paper as I went. Suddenly I comprehended, as I read the bold headlines 'Peace Treaty Is Signed.'"

The incident of the old German may or may not be typical, but it at least indicates that among many the tension produced by the war has been broken and replaced by a happier frame of mind. June 28 marks the consummation of a progression of events occurring during the last five years and profoundly affecting individuals and nations. Whatever the terms of the peace treaty may be, and however they may affect the several nations signing it, the fact remains that in that treaty we have, as near as it is possible to attain by human efforts, a world constitution.

Our experience with our own constitution may well lead us to feel that the peace treaty will clarify and strengthen international relations. There will be doubts and misgivings, but the important fact remains that the treaty will become just what we make it. A broad spirit of acceptance and tolerance will make it a success. The world grows smaller, population increases, elbow-room becomes harder to get; more and more is it imperative to cultivate a spirit of amity, comradeship, and understanding among nations.

Americanization

AMERICANIZATION as we understand it has for its object the saving of 30,000 lives per annum in the United States, the saving of 100,000 injuries, and the saving of millions of dollars to our mines and industrial plants, but more than all these its object is to save the United States for our children and ourselves. Secretary Lane, in an address before the Washington Conference of Americanization Specialists, in May, said:

> The right of revolution does not exist in America. We had a revolution 140 years ago which made it unnecessary to have any other revolution in this country, because it was fundamental. One of the many meanings of democracy is that it is a form of government in which the right of revolution has been lost by giving the Government wholly to the people. Revolution means revolt. Against whom are we to revolt in the United States excepting the people of the United States?
>
> If we Americans do not like officials, programs, policies, measures, systems, we can try others, but in Europe the right of self-determination as to domestic concerns has been denied, and therefore the right of revolution has been preached.
>
> No man can be a sound and sterling American who believes that force is necessary to effectuate the popular will. As we have taken from the duelist his pistol and compelled him to seek redress in the law, so in the larger affairs of the nation we have said, "This is your country. Make it what you will; but you must not use force, for when you came here and became a citizen you gave over the right to resort to anything but public opinion and the methods of the law in the determination of national policies. If you are in a minority you must wait until you become a majority, and as a majority you must be content to prevail by processes which respect the rights of the minority."
>
> Americanism does not mean that any one economic system is right, or that the United States is a perfected land; it does not mean that any one social philosophy must be accepted as the final expression of truth; but Americanism does mean that we have evolved for ourselves machinery by which revolution, as a method of changing our life, is outgrown and outlawed.

That the foreign-born citizens may grasp this idea, the start must be made with the English language. John H. Finlay aptly said in his remarks before the same conference:

> To make here in America a permanent Pentecost that all the people of the land may understand one another, we must begin with a common language. I know that this is not the sufficient thing, but we must begin with words, for all the good and bad that gets done in the world is done through words.

The large mine or reduction works has a duty to itself and the community in bringing about a condition on its properties requiring that notices be printed in but one language, the English language. With the small mines the duty is no less imperative, but is more difficult of accomplishment. Here it means co-operation between the mine management and the local community.

Americanization will not be accomplished through closing our ports to immigrants over a period of four years or any other period, but much may be accomplished through teaching those already with us, and teaching the others as they come.

Worth-While Men

CAN-DO men are worth-while men. The urge of necessity develops self-reliance. Can-do and self-reliance are complements of each other. On the battle-fronts of Europe men were compelled to think fast and to act. They were compelled to do with what they had. The construction of a billet, a bridge, a road, the extrication of a motor truck from a shell hole, or the rescuing of the wounded under fire became imperative necessities. Our soldiers did all of these things. They also vanquished the enemy. And in doing these things they were under a great co-ordinated system, the American Army.

It is difficult to estimate the value of the Army experience to each individual. Each was the better for it. The returning soldier is a greater asset to the country than he formerly was as a citizen before he donned the uniform. The Army has been quick to realize that it is a great training school where men are made. How to take care of himself; how to work with others; how to obey orders; how to use his time to best advantage—these are a few of the fundamental lessons that the Army has instilled in the soldier.

That the new plane attained by the Army may be made permanent is the wish of all who have its interests at heart. At the recent meeting of the New York Section of the American Institute of Mining and Metallurgical Engineers, Major Stuart elucidated and explained the new purpose of the Army. He impressed those present with the economic importance of the Army

when considered as a training school for men. All who heard him were quick to catch the drift of his argument. There will be substantial agreement that the Army has contributed a large number of creditable and valuable men to our citizenry.

Increasing Iron-Ore Resources

THE heavy drain upon the domestic iron-ore resources caused by the enormous production of iron and steel naturally raises the question of the life of the deposits and the probability of maintaining the grade of the ores produced. Despite the productiveness of the Minnesota deposits, there is a limit. It is true that this limit is in the future, but that future may not be so far away. Both the grade of the ore and the proportion of bessemer ore have sensibly diminished. Were the present merchantable ores of Minnesota our only resource in that state, the prosperity of the iron-mining industry there might be seriously curtailed within several decades. Fortunately, however, there exists a large tonnage of low-grade taconite which contains upward of 30 per cent of iron in the form of magnetite. Until recently this ore was not merchantable, for obvious reasons.

At the recent meeting of the New York Section of the American Institute of Mining and Metallurgical Engineers, Horace V. Winchell, president of the Institute, related how, by well-known metallurgical methods, the low-grade taconite can be treated and a merchantable ore of bessemer grade and higher in iron content than the Mesabi ore obtained. This is a significant and important achievement. It was not obtained casually, but is the result of careful and persistent experimentation. Mr. Winchell paid special tribute to Walter G. Swart for his able work in conducting the investigation which has resulted so happily. The intelligent application of engineering principles to the solution of problems of this kind gives further emphasis to the value of the engineer to the community.

When actual exploitation of these deposits along the proposed lines will take place is problematical. In all likelihood this will be when plant and operating costs reach a level that will insure an adequate margin of profit to justify the large capital expenditure.

Nevertheless, great credit is due the men who have solved this vital problem.

Sealing Off Water in Oil Wells

THE wholesale development of oil-bearing formations has brought with it a number of peculiar engineering problems, among the more important of which is the necessity of preventing the contamination of the oil with water which leaks in from contiguous strata. Individually, the operations of a producer may be of importance to himself alone. He may lose the product of a well by excessive infiltration of water. This may be due to his own carelessness or ignorance. For this he pays his own price. Where, however, there are a number of producers operating in the same field, the operations of each company become of considerable importance to the others.

Carelessness or ignorance is never excusable, even when the guilty individual is the only sufferer, but if his neighbors also suffer, through no fault of their own, there should be a strict accounting. The continuity of structural conditions in the large oil fields necessitates a considerable degree of co-ordination of the efforts of individual companies, particularly where there are important water-bearing formations in close proximity to the oil sands, either above or below. The infiltration of water caused by a single well may adversely affect the product from a number of wells. It is on this account that geologists and oil men combine to study the conditions in a given field, to the end that all of the recoverable oil from the field can be obtained, and the greatest length of life of the particular area assured.

Methods for coping with infiltrating water have been progressively developed. At present there are a number of effective processes for handling both top and bottom water. All involve the sealing off of the troublesome stratum by the use of either cement or mud-laden fluid in conjunction with the steel casing. Structural conditions and the nature of the water-bearing stratum determine largely the selection of the method and the details of its application. The degree of success attained depends upon the thoroughness of the knowledge of the underground conditions and the skill and experience of the operators who are engaged in conducting the sealing operations.

Knowledge of underground conditions cannot usually be obtained entirely from a single well, but should be derived from the detailed logs from a number of wells in the same field, as well as from the behavior of the producing wells. This implies that there should be some clearing house of information in each field from which data could be obtained to guide the individual operator and to warn him of the dangerous horizons. The necessity for this has been recognized, and in oil fields where water troubles are critical operators have co-operated with one another to minimize the difficulty.

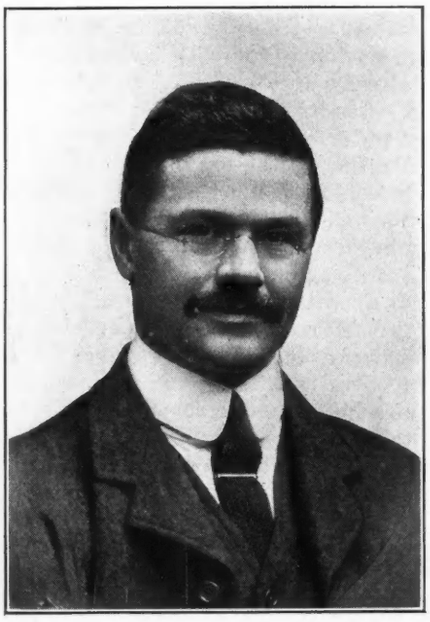
In California a law providing for the protection of oil deposits in that state against water and other damages following improper development methods has been in operation for three years. A department of the California State Mining Bureau administers the law, and considerable progress has been made in establishing records and field procedure useful in controlling the situation. A report recently issued by the California State Mining Bureau contains descriptions of many interesting examples of the practice of sealing water-bearing formations, and should be useful to operators and engineers. On the whole, this state control has resulted in material benefit to the California oil industry. It emphasizes the important results that accrue from organized, intelligent direction.

In the current number we are publishing, on page 11, an article by Seth S. Langley, which gives in detail an insight into the practical details of this all-important problem.

Progress in Milling

IN THE Milling Number of the *Journal*, published on June 28, the last paragraph of the editorial, "Progress in Milling," is to be taken as referring solely to the Minerals Separation "means" of introducing air. The mining industry still has the possibility of the "bubble-column" process, commonly called the pneumatic-cell process, with an economical use of oil. The recent decision of the U. S. Supreme Court clearly indicates the intention of that court to hold the patentees strictly to the "means" disclosed in their patent, No. 835,120.

Some Prominent British Engineers



ALFRED JAMES
Distinguished metallurgist of international reputation, who has been particularly identified with the development of the cyanide process.

THOMAS KIRKE ROSE
Assayer of the British Mint. Author of "The Metallurgy of Gold," and a distinguished authority on that subject.

HUGH F. MARRIOTT
A mining engineer who has been prominent in the operation of gold-mining interests in the Transvaal.

F. W. HARBORD
A metallurgist closely associated with the British iron and steel industry, and of wide experience and high attainments in general consulting practice.

Developments in Lake Superior Milling

Copper Ore-Dressing and Leaching Practice—Two Types of Ore Necessitate Different Methods, Of Which the More Complicated Includes Stamping, Regrinding, Tabling, Leaching Of Sands by Ammonia Solutions and Flotation of Slimes

By C. H. Benedict
Metallurgist, Calumet & Hecla Mining Co., Calumet, Mich.

As is well known, two principal types of copper ore are mined in the Lake Superior region, both of which contain native copper, but which differ materially, not only in the physical character of the gangue but also in the physical character of the contained copper. The conglomeratic ore is a hard, close-grained rhyolite, characteristically composed of pebbles, and in which the copper forms the cementing material in the interstices between the pebbles. In the amygdaloidal ore, on the other hand, the copper occurs in more massive form than in the conglomerate and the rock is much softer.

FIG. 1. AHMEEK STAMP MILL, HUBBELL, MICH.

Numerous amygdaloidal lodes are being worked, and each lode differs to some extent from all the others, both in physical characteristics and in rock constituents, and more particularly as regards the richness of the ore and the size and distribution of the copper particles. The only conglomerate ore mined at present is from the Calumet & Hecla mine, and, inasmuch as the lode is rich and the copper is in a fine state of subdivision, metallurgical development has been more pronounced in the treatment of this "rock" than in the case of any other "rock" in the district.

The question of the best metallurgical treatment of the amygdaloidal ore is most often a compromise between the possible metallurgical recovery and of the economics of that recovery. That is to say, though it is possible to get a high metallurgical recovery, because of the nature of the ore and the general simplicity of the metallurgical treatment, it is not always economical to carry that recovery to its highest point, as the additional value is not warranted by the increased cost incurred. The richest ore now milled in the Lake Superior region comes from the Champion mine of the Copper Range Co., which throughout 1918 gave a recovery of 36.6 lb. copper per ton of ore milled, with a tailing loss of probably six to seven pounds per ton. The lowest-grade ore profitably milled in the district during the same year was from the Kearsarge lode of the Osceola Consolidated Mining Co., which yielded only 12.62 lb. per ton, with a tailing loss of less than four pounds.

It is obvious that it is possible to carry the metallurgical treatment of ore further when one is treating material assaying 40 lb. copper per ton than would be possible with corresponding material assaying but 16 lb. copper per ton. If one is inclined to criticize the lack of fine grinding or some other relatively crude method prevailing in some mills, one must take into account the fact that the value of the fine copper may not be present in sufficient amount to warrant a better process. The amygdaloidal ore mined by the Isle Royale Mining Co., for example, contains a large percentage of heavy copper, so that it is possible to make a recovery of more than 80 per cent by stamping it in a steam stamp and screening it to a maximum size of $\frac{3}{16}$ in. without the

necessity of finer grinding of the $\frac{3}{16}$-in. material. On the amygdaloidal ore of the Kearsarge lode, and also on that of the Pewabic lode, the metallurgical recovery is not nearly as good for the same degree of crushing. To get satisfactory results it is necessary to resort to regrinding of the coarser tailings.

Copper Is Coarser in Amygdaloidal Lodes

In all of the amygdaloidal lodes the copper is in a coarser state of subdivision than in the Calumet conglomerate. Thus, to release the mineral values, it is necessary in the case of the Calumet conglomerate to grind to a finer size than for the amygdaloidal ore. The big problem for the metallurgist is not so much to devise a method of saving the copper when liberated as it is to decide to just what extent he is justified in going into the matter of saving. His judgment in this respect must be based on many factors, some of which are within his control and some of which are not. The equipment that would have been justified at 26c. copper would not be economical at 15c. copper, and, in the same way, an equipment that would be justified for a given price of copper for a given quality of ore might, in turn, not be justified in case the ore became two or three pounds leaner. That is the reason for a statement made earlier in this article that the complexity of treatment and the choice of the flow sheet are, to a great extent, a question of the value of the copper per unit of ore.

One feature that must be clearly understood in any review of the metallurgy of Lake Superior is the influence of the presence of coarse metallic copper, because of the fact that it is metallic and therefore not subject to subdivision at the will of the operator. As is well known, one may have masses of metallic copper underground of almost any size up to hundreds of tons' weight, but as the ore comes to the mill the largest masses of copper have been cut up and one must reckon with pieces that might be contained in rock of the maximum size of, say, 12 by 12 by 14 in. in dimensions. It is because of the possible presence of masses of copper of this size that the automatic feeding of stamps has not been practiced in the Lake Superior region.

It would be easy to devise a feeder for a stamp that would maintain the proper load in the mortar, and many efforts have been made in this direction, but until some one can devise a plan whereby the large masses of copper can be automatically removed from the heads at the same time, there will be no saving of labor in having the automatic feeder, because it is essential to have an attendant present at the feed shoot to remove the large masses of copper. If they get into the mortar they may cause serious damage, such as the breaking of the shoe, stamp stem or piston rod, and if they do not do this they will accumulate in the mortar to such an extent as to make necessary the removal of the grates and the shoveling out of the mortar contents. This refers to masses of copper eight or ten inches in size.

Provision has been made for the removal from the mortar of masses up to three or four inches in size by means of two devices patented in about 1900 independently by F. E. Woodbury, now deceased, and by Charles and Henry Krause. The devices are known as mortar discharges and have for their object the removal of coarse copper from the mortar, for which purpose they are most effective.

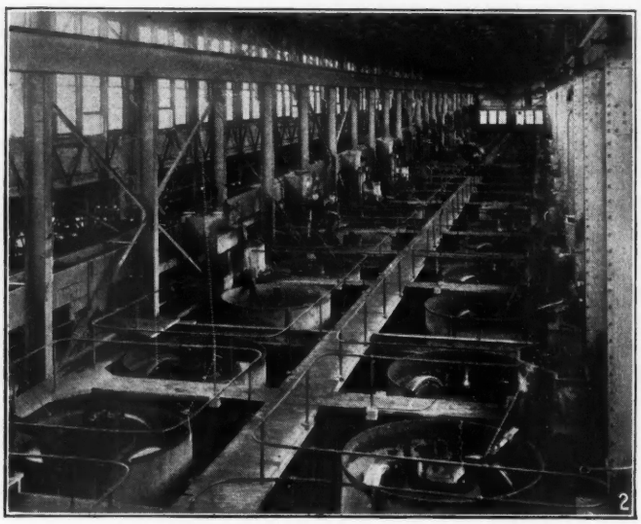


FIG. 2. OLD REGRINDING PLANT OF THE CALUMET & HECLA MINING CO.

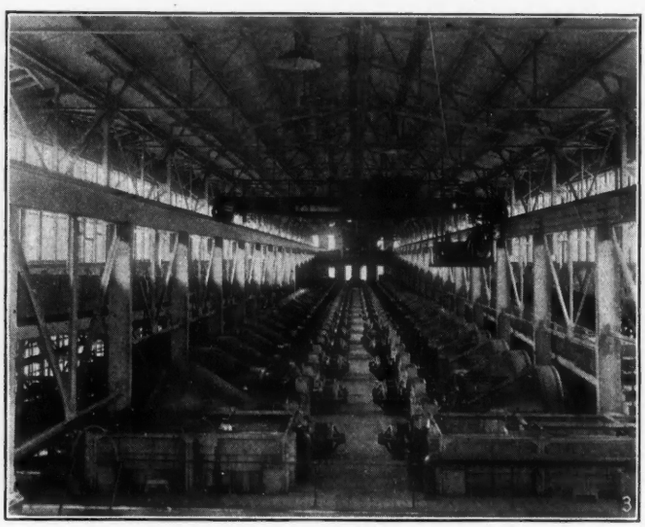


FIG. 3. PRESENT REGRINDING PLANT OF THE CALUMET & HECLA MINING CO.

The Krause discharge is a plain hydraulic discharge opening into the mortar through the staves at a point about five inches below the level of the bottom of the mortar grate. The Woodbury device also operates through the staves, but at the level of the bottom of the mortar grate, and is in the nature of a jig with a pulsating current, as opposed to the constant hydraulic pressure used in the Krause discharge. These two devices are effective in removing from the mortar such copper as may be within their range, which is roughly from $\frac{5}{8}$ up to 4 in. in size, and any copper coarser than this should be removed by the stamp attendant, or "head feeder," as he is locally known. It is the presence of these large masses of copper that makes it impracticable to use a gyratory crusher or even coarse rolls for the preliminary crusher, and the steam stamp has been unique and unchallenged for this purpose.

It is not only on account of the size of the copper that the steam stamp is so efficient, but also, strange to say, because of the shape of the copper. This is really worth consideration, as those who operate mills in the Lake Superior region find a great deal of confusion of ideas on the part of the sulphide-ore operators in respect to the last-named feature.

Before the days of flotation the most common criticism heard of Lake Superior practice was the opinion that the steam stamp caused too much abrasion and consequent loss of copper. To anyone who has tried to abrade copper, and then at the same time attempted to crush amygdaloidal rock, the fact would quickly be forced home that the rock will slime while the copper still remains in its original form. Further than this, it is really necessary that the copper be somewhat "punished" before it is given jig or table treatment. A great part of the copper is in such shape that the surface is out of all proportion to the mass, and by the action of the stamp it is either hammered into a more compact body or is subdivided into a number of pieces each more compact than the original. This matter of the shape of the copper particles becomes much more important in the finer states of subdivision, where forces other than gravity have freer play.

In the early days the inefficiency of the metallurgical process was recognized just as keenly as it is at present, but there was no form of fine grinder that was sufficiently cheap in operation to warrant its installation on these relatively low-grade ores; more particularly so because, even with the release of the copper particles from the ore, their recovery was problematical.

USE OF ROLLS NOT SUCCESSFUL

The use of rolls for fine grinding was not a success and could not have been a success, because they simply cracked the particles of rock and released the copper in its original shape, which ordinarily is so pronged and irregular that it could not be saved on a vanner or on a Wilfley table. The same general effect occurs with the Huntington mill, the crushing action of which is similar to that of a roll. The effect of the shape of the copper was definitely recognized by the early operators, who attempted to use grinding devices that would put the flat copper particles into more of a pellet form. For this reason the old Herberle grinder found great favor in the Calumet & Hecla mills before the days of the Wilfley table, because its action was such that the copper was rolled up into a globular or pellet form which was easily saved by a jig.

At present a crushing device is being developed which it is confidently believed in some quarters will accomplish the same result. The device is known as the Lovett grinder. It is a horizontal disk grinder, one of the disks having an oscillating and the other a circular motion, so that the grains of rock are torn apart and the copper is rolled up into a more compact form than it originally had in the ore.

It was not, however, until the introduction of the Chilian mill, taken in conjunction with the Wilfley table, that it was possible in the Lake Superior region to obtain an economical recovery of copper from particles finer than $\frac{3}{16}$ in. The Chilian mill had not met with great favor in Western practice, because of its sliming proclivities, which made it, on the other hand, acceptable to native-copper metallurgy. The copper freed by the Chilian mill was in the shape of flat grains and was in excellent condition for a good recovery by the Wilfley table. Up to the time of the introduction of the pebble mill, the Chilian mill was the only type of fine grinder used generally in the Lake Superior region, and it found a place in the stamp mills, not only of the Calumet & Hecla Mining Co. but also of the Copper Range, the Mohawk, and the Lake Milling Co.

With the introduction of the Hardinge grinder, which fortunately occurred at about the same time that cheap power became available, owing to the adaptation of the low-pressure turbine to the utilization of the exhaust steam from the stamps, fine grinding may be said to have secured an established place in the metallurgy of the Lake Superior district. Each important plant now has one or more mills in operation, and each operator has attempted to find the economical point to which this fine grinding can be carried on his particular ore under the varying conditions of the copper market.

In the Isle Royale plant, which has a capacity of about 2,000 tons of ore per 24 hours, one mill is in operation, regrinding middlings from the jigs and tables; and this seems to be about the proper practice for the ore, as it contains a large percentage of the copper in coarse particles. In most of the mills treating amygdaloidal ore, however, the practice is to have at least one pebble mill for each stamp unit of 700 tons' daily capacity. This might be termed standard practice for medium-grade amygdaloidal ores.

The Champion and the Baltic mills of the Copper Range Co. stamp the highest-grade amygdaloidal ores in the Lake Superior district, and in both there are a sufficient number of ball mills in use to regrind all jig tailings. The Quincy plant has two Hardinge ball mills in operation and is now installing five Marcy ball mills for the regrinding of its jig tailings.

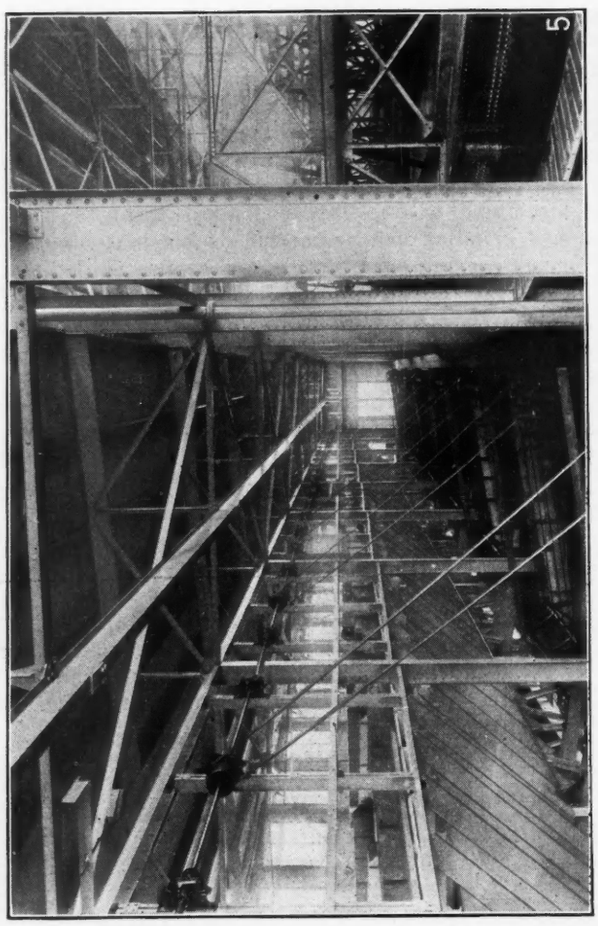
On the conglomerate ore of the Calumet & Hecla Mining Co., there are sufficient pebble mills in operation to regrind all jig and table tailings so that the product passes a 28-mesh screen and about 40 per cent passes 200 mesh. In all of the plants the product of the ball and pebble mills, with little preliminary classification, is treated on Wilfley tables, and a recovery of from 35 to 60 per cent of the copper is effected. The resultant tailings in all mills except those treating conglomerate ore is sufficiently low in copper to throw away. Only in the mills of the Calumet & Hecla does further metallurgical treatment follow the tables.

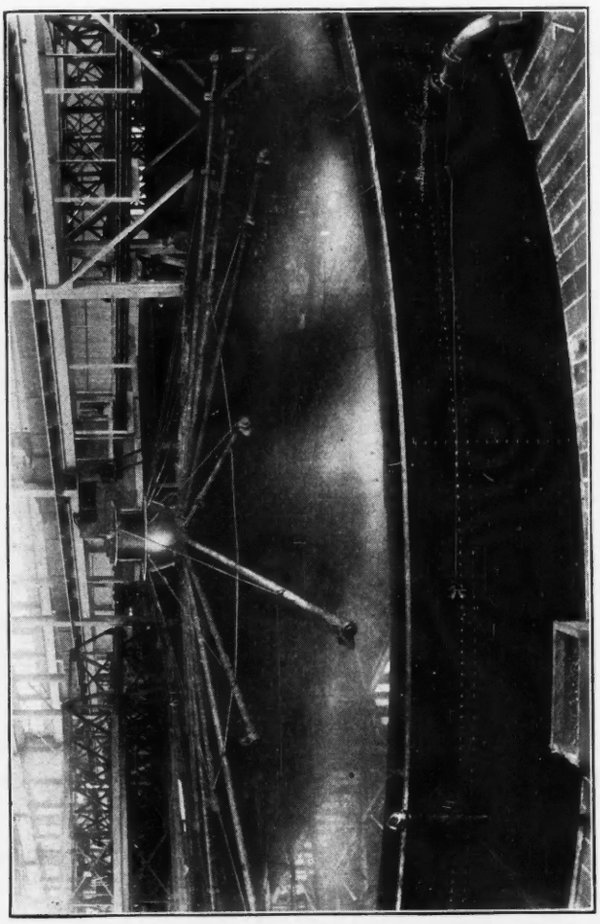
CALUMET & HECLA CONGLOMERATIC ORE CONTAINS FINELY DIVIDED COPPER

The conglomeratic ore of the Calumet & Hecla Mining Co. is in a class by itself, because of the fact that, as stated earlier in this paper, the copper is in a fine state of subdivision and also because the ore is richer than any of the amygdaloidal ores except the product of the Champion and the Baltic. The pebble mill regrinding followed by table treatment still left copper amounting to seven or eight pounds per ton, and it was realized that the limits in mechanical separation had been reached.

Efforts had been directed for many years to find a leaching method that would recover the copper commercially, and finally, in 1912, a process was invented by the author[1] which solved the problem. The leaching plant has now been in operation three years, and has been an entire success. For 1918 there was recovered 8,035,156 lb. refined copper from the treatment of 1,005,015 tons of sand, at a cost, excluding smelting and selling, of 7.71c. per lb. This showed a copper recovery of about 75 per cent on the material treated by leaching, and brought the recovery on the original ore up to better than 90 per cent. The cost of the leaching operation is about 40c. per ton under normal conditions, which would necessitate a grade of ore assaying at least six pounds per ton before one could hope to make the

[1] *Eng. and Min. Journ.*, July 14, 1917.





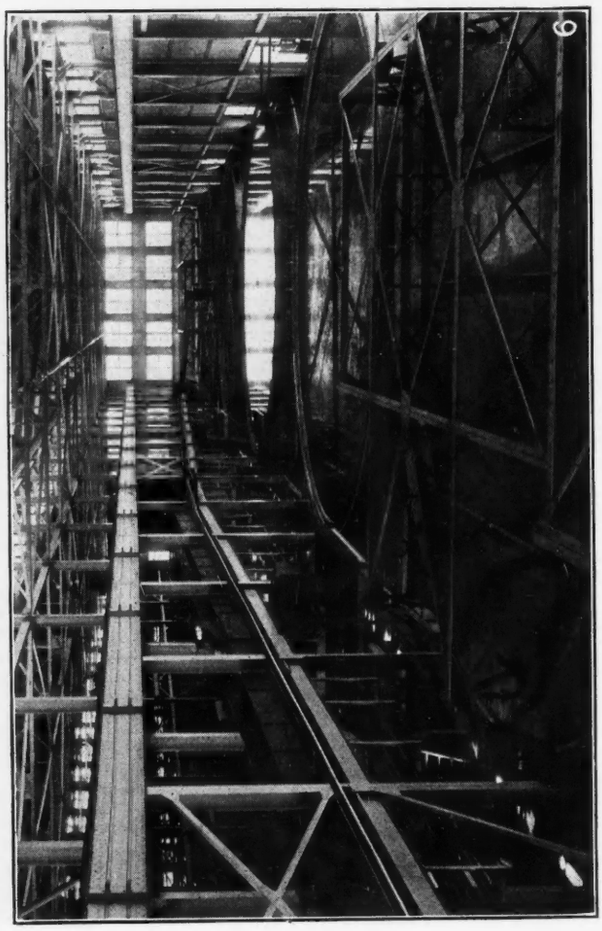


FIG. 4. WILFLEY TABLES FOR FIRST TREATMENT OF REGRIND. FIG. 5. SEPARATION OF SLIME FROM LEACHING SAND BY DORR CLASSIFIERS. FIG. 6. LEACHING PLANT, SHOWING TANKS AND DISTRIBUTING LAUNDER. FIG. 7. SAND DISTRIBUTOR AND REMOVABLE LAUNDER

process commercially available, and, as most of the amygdaloidal ores of the district yield a tailing just under this, there does not seem to be much hope for the extension of the ammonia leaching process to such ores, although it is perfectly adaptable to them and will effect a good metallurgical recovery.

FLOTATION IN TREATMENT OF COPPER ORES

The latest development in the treatment of Lake Superior ores is the adoption of the flotation process. The leaching process has been worked out only for the treatment of the sands, and flotation is so efficient for the treatment of slimes that it is not conceivable that the leaching process could compete with it, even were the many mechanical problems worked out that would arise in an effort to adapt ammonia leaching to slimes. None of the amygdaloidal mines has installed the flotation process as part of the mill practice, although the Winona mill had made a beginning toward this end at the time it was closed down following the signing of the armistice.

Both the Copper Range and the Quincy are doing some experimenting with flotation, but neither company has even an experimental unit in operation. At the White Pine mill, where the ore is neither conglomeratic nor amygdaloidal, but consists of sandstone and slate, flotation is part of the regular practice, and all the tailings are subjected thereto. In this mill, the flotation is applied to the ore following the table treatment and as a final process. The ore consists of copper in a fine state of subdivision in sandstone, and in an almost microscopic state of subdivision in slate, so that the mill recovery, previous to the introduction of flotation, did not exceed 60 per cent. Flotation processes effect a recovery of about 65 per cent on the material treated, so that the final mill recovery is fairly satisfactory.

It is on the conglomeratic ore of the Calumet & Hecla Mining Co. that the only flotation plant of any size is in operation. Up to the time of the introduction of flotation, slime practice had consisted of treatment of the pulp on round tables and of the concentrate produced by these on Wilfleys. This round-table Wilfley practice has now been discontinued, and the slimes, as they leave the Woodbury classifier following the stamp, are subjected to the action of a two-spigot hydraulic classifier, and the resultant spigot products are treated on Wilfley tables. The overflow of this classifier goes to a 25-ft. diameter three-tray Dorr thickener, and the product of this thickener is treated in flotation machines of the Minerals Separation type. For each conglomeratic-ore stamp unit of 350 tons' daily capacity there is one 25-ft. thickener, and the thickened product from four thickeners, amounting to about 400 tons daily, is treated on a 24-in. Minerals Separation machine of 600 tons' nominal capacity. Of the sixteen cells of this M. S. machine, two are used for mixing only, and two for cleaning up the concentrates of the other twelve.

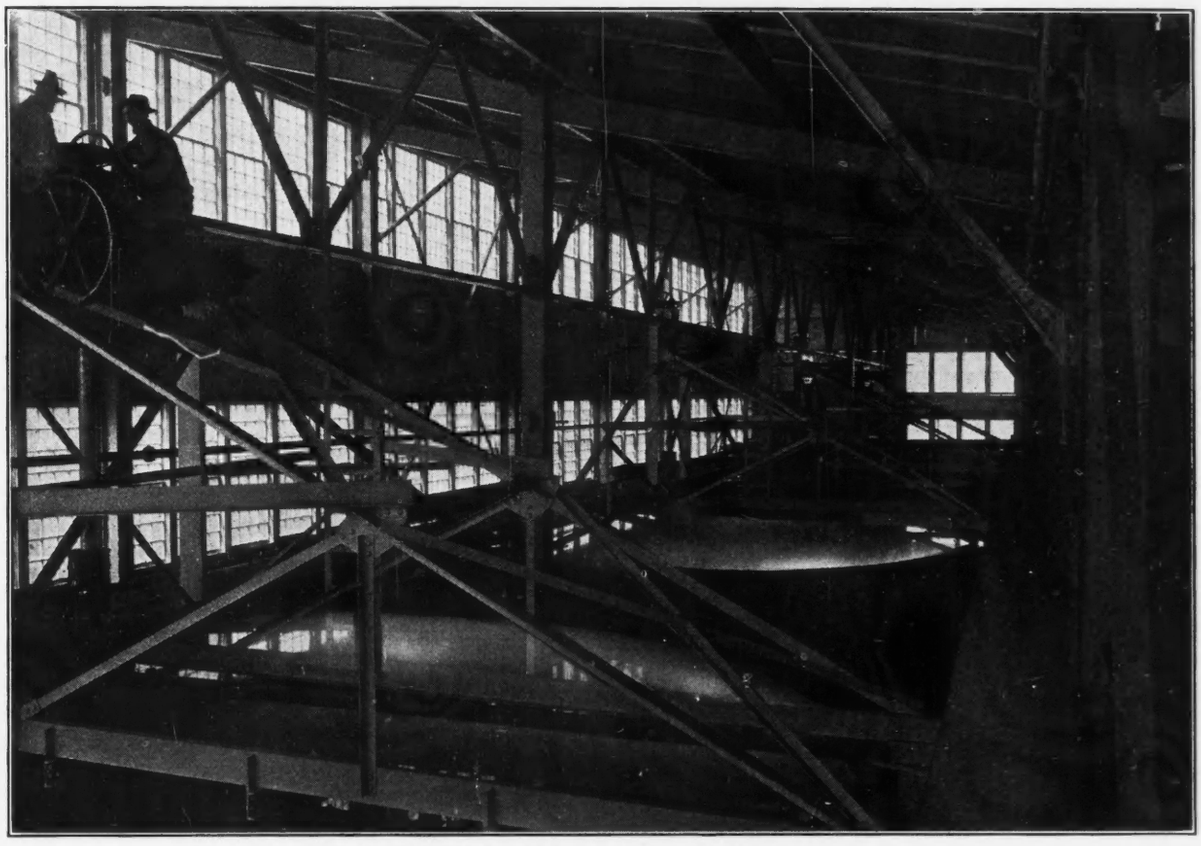


FIG. 8. FLOTATION PLANT OF CALUMET & HECLA

The concentrates go to a Dorr thickener, and from this to an Oliver filter, from which the material is scraped into the concentrate cars for treatment at the smeltery. The plant has been working for just about a year and indicates a recovery of about 65 per cent of the contained copper and at a cost of possibly 20c. per ton, including royalty. In addition to this plant of 2,000 tons' daily capacity on the Calumet & Hecla conglomerate, a second plant of like capacity is being built, which is to treat the slimes resulting from the regrinding operations, both of the current tailings and of the tail-

ings from the lake. This plant will consist of eight Dorr thickeners, 40 ft. in diameter, three-tray, and for the treatment of the thickened product will have four M. S. type machines of 600 tons' nominal capacity each. The plant should be in operation some time during the summer and will give a total flotation capacity of 4,000 tons. The capacity of the leaching plant is also 4,000 tons, so that the combined re-treatment plants will be able to handle the normal production of 5,000 tons daily of ore from the mine and 3,000 tons from the accumulated tailings.

With the successful working out of the leaching and flotation processes on native copper ores, the operator in the Lake Superior copper region has at his command all necessary means for good metallurgical recovery. Milling costs are low, and can be lowered by cheaper power resulting from a more general installation of low-pressure turbines, which have been found universally satisfactory. Grinding costs may be still further reduced by improvements in machines or methods. Neither jig nor table practice has been improved for some years, the re-treatment of the tailings from these machines making them of lesser importance than formerly. It is to the economics of the problem that the mill man must give greatest attention.

Report of Chile Copper Co.

Reserves, Production, Equipment, Improvements, New Construction—Twelve Shovels Are Now Operating—Leaching Recoveries High

THE third annual report of the Chile Copper Co., for the year ended Dec. 31, 1918, shows that 3,745,248 dry tons of ore was treated, averaging 1.64 per cent copper, the recovery from which averaged 82.17 per cent, or 51,068 tons of copper produced, compared with 2,905,156 tons treated in 1917, averaging 1.76 per cent, with recovery of 81.81 per cent, or 44,185 tons of copper produced. The positive and probable ore reserves as of Dec. 31, 1918, are estimated as follows: Oxidized ore, 336,510,349 tons, of 1.91 per cent copper; mixed ore, 151,000,000 tons, 2.98 per cent copper; sulphide ore, 210,000,000 tons, 1.84 per cent copper; total, 697,510,349 tons, 2.12 per cent copper.

In 1918, there was produced 102,136,658 lb. of copper, of which there was sold and delivered 84,695,299 lb., at an average price of 24.713c. per lb. of copper. The total cost of production was 17.885c. per lb. of copper sold, distributed as follows: Cost of production, including depreciation, selling, delivery, New York expenses, taxes, and less miscellaneous income, was 15.318c. per lb. Cost of plant and equipment installed in prior years and abandoned or superseded by other structures or machinery has been charged against the year's income, equivalent to additional cost of 0.049c. per lb. Depletion of mineral deposits has been charged against income at a cost of 2.518c. per lb.

Operations at the Mines

Ten hectares of ground situated along the northern border of the district were acquired for use as a dump site and railroad right of way. Only five prospect holes were drilled, with total footage of 642 ft. There was loaded, to be sent to the reduction plant, 3,401,627 metric tons of 1.71 per cent copper. A total of 557,800 cu.yd. of waste was removed from all benches, averaging 0.37 per cent copper. Underground development was advanced 34,721 ft. Since the beginning of the underground blasting tunnel development a total of 70,950 ft. of tunnels has been driven, of which 23,739 has already been blasted.

During the year, 1,458 holes were drilled, with a total footage of 53,268 ft. Since operations began, 3,812 holes have been drilled, with a total footage of 145,398 ft. The ground broken was 4,140,318 cu.yd. No ore has been taken from the dumps. The tonnage remaining in the several piles is 207,267 tons, averaging 3.85 per cent copper.

Twelve shovels are in operation, two of which are standard 103-C Bucyrus electric machines. These electric shovels are giving excellent service, their operation being in every way more economical than steam shovels. One Baldwin, seven Porter and thirteen Panama locomotives are in service attending shovels. Two more 103-C electric shovels have been erected and will go into service when main hoisting motors are received. One 225-B electric shovel is under erection and will be put into service within ninety days (report dated Feb. 5). Two 1,050 ft. motor-driven compressors were installed.

In the secondary crushing plant, the operation of rolls was discontinued early in 1918. The third section went into service on Mar. 21, and on July 2 a complete installation of eighteen fine reduction Symons disks were in operation. The feature of the completed disk installation was the gradual cutting down of the oversize on .371-in. screen. During the first quarter this oversize was about 50 per cent, whereas for the last quarter it averaged 18.5 per cent.

In the leaching division, the important feature was the increased extraction. An average of 87.9 per cent was reached, as against 82.2 per cent for 1917, owing principally to the finer grinding of the ore. The maximum was reached during November, when an average of 91 per cent was obtained.

The new de-chloridizing plant should be in operation before the middle of 1919, with greatly improved equipment. The feature here was the development of a cylindrical copper drum for precipitating cement copper, in place of the trommel.

The following were among the important additions to the plant equipment completed during the year: Symons crusher house, first west extension; solution sump; foundry and oxygen generation plant. The following features are well under way and should be completed early in 1919: sewage system and disposal plant; machine shops; Toconce pipe line, and eleven-bay extension to electrolytic tank house. Progress in all construction work is still seriously retarded, owing to difficulties in obtaining material on account of embargoes on exporting from the United States, as well as shortage of shipping facilities.

The average rate of exchange between Chilian currency and United States currency was 3.37 for 1918, as against 3.90 in 1917. This low exchange had the effect of increasing the payroll for native labor by $800,000 United States currency over what it would have been at the previous year's exchange.

The Record of Tax Receipts of the Ontario Government for the year ended Oct. 31, gives the total amount paid by mining companies as $863,547. The principal items are: Hollinger Consolidated, $70,473; International Nickel, $600,000; Nipissing, $64,927; Mond Nickel, $45,769; Kerr Lake, $34,460; McIntyre-Porcupine, $8,937; Miller Lake-Obrien, $8,781.

Sealing Water in California Oil Fields

Productivity of Oil Formations Is Sometimes Seriously Affected by Water Penetration—Improved Methods of Sealing Water-Bearing Formations Have Been Devised

BY SETH S. LANGLEY
Mining Engineer, General Petroleum Corporation, Taft, Cal.

IN CALIFORNIA, all drilling operations are under the supervision of the California State Mining Bureau, which maintains an office in each of the principal fields. A definite procedure under supervision of the bureau is followed from the time of location of the well, while it is being drilled, and through its productive life to final abandonment. The purpose of this is to provide proper protection of the underground oil and gas resources. Each major operation is inspected, and either accepted or rejected, by a deputy inspector, and there has grown up a cordial coöperation between the bureau and the operators. The California State Mining Bureau should be congratulated for its personnel and for the results that have been obtained.

Before describing the various methods of sealing water, or water shut-off, as it is more generally designated, it is necessary to present some figures to show the necessity of successful water control in the California oil fields. I am indebted to the California State Mining Bureau for some of the statistics given in Table I.

TABLE I. TOTAL OIL AND WATER PRODUCED BY ALL WELLS DURING FISCAL YEAR, JULY 1, 1917, TO JULY 1, 1918

Field	Oil, Bbl.	Water, Bbl.	Water, per Cent.
Coyote Hills	11,743,952	894,534	7.1
Olinda	2,909,421	432,899	12.9
Brea Canyon	1,615,240	661,779	29.0
Puente	19,415	1,838	8.6
Whittier	1,102,453	1,013,680	48.0
Montebello	3,263,389	214,283	6.1
Salt Lake	1,134,797	764,975	40.2
Newhall	119,289	132,656	52.7
Total and average	21,907,956	4,116,644	15.8

TABLE II. AVERAGE DAILY PRODUCTION

A—Average Daily Production of Fields in Ventura County.

Field	Oil, Bbl.	Water, Bbl.	Water, Per Cent.
Piru	378.5	629.8	62.5
Simi	202.0	26.8	12.1
Bardsdale	1,597.6	125.5	7.2
Sespe	112.6	19.7	9.4
Santa Paula	94.8	44.8	33.4
South Mountain	591.0	0.3	0.05
Ojai	210.4	408.1	66.0
Ventura	161.8	527.6	76.7
Total and average	3,348.7	1,782.6	34.5

B—Average Daily Production in Santa Barbara, San Luis Obispo, Monterey, and Santa Clara Counties

Field	Oil, Bbl.	Water, Bbl.	Water, Per Cent.
Santa Maria	8,765	4,089	31.8
Cat Canyon	2,604	161	5.8
Casmalia	6,182	1,786	22.4
Lompoc	1,273	1,304	50.6
Los Alamos	....	....	....
Arroyo Grande	202	20	9.0
Sargent	57	4	6.6
Summerland	....	....	....
Total and average	19,083	7,364	28.0

C—Average Daily Production in Fresno, Kings and Other Counties.

Oil, Bbl.	Water, Bbl.	Water, Per Cent.
45,044	10,197	18.4

D—Average Daily Production per Well in Kern County.

Field	Oil, Bbl.	Water, Bbl.	Water, Per Cent.
Midway	51.9	10.9	17.3
Sunset	61	21.5	26.0

The following figures in Table III, for Sections 4 and 5, Township 11 N., R. 23 W., S. B. B. M., and Section 32, Township 12 N., R. 23 W., S. B. B. M. illustrate the complex problems to be met in the Sunset field:

TABLE III. WATER AND OIL PROPORTIONS IN SUNSET FIELD

Well No.	Zone	Oil, Bbl.	Water, Bbl.	Water, per Cent.
1	A	60,461	1,349	2.18
2	A	1,040	2,145	67.3
3	A	100,568	7,521	6.9
4	A	100,485	1,521	1.49
5	A	270,634	400,000	59.3
6	A	501,214	60,357	10.7
1	B	856,322	66,685	7.2
2	B	144,893	143,632	4.9
3	B	112,839	13,456	10.7
1	C	87,308	48,395	38.8
2	C	5,037	80,527	94.1
3	C	795,039	139,802	14.9
4	C	6,527	54,634	89.2
5	C	500	25,000	99.6
6	C	121,166	880	0.63
7	C	264,556	1,161	0.43
8	C	452,669	.....	....

Zone A, the uppermost oil horizon, is about 100 ft. in thickness, and has a water zone 50 ft. above it. The top of Zone A is about 2,600 ft. from the surface. Zone B, the top of which is approximately 100 ft. below the bottom of Zone A, has a thickness of 200 ft. There is a water zone between Zone A and Zone B. The top of Zone C, which is 400 ft. thick, is 100 ft. below the bottom of Zone B. There is a water zone with two water sands between zones B and C. The total production to Feb. 1, 1918, of oil and water from the three zones is shown in Table IV.

TABLE IV. TOTAL PRODUCTION TO FEB. 1, 1918, IN SUNSET FIELD

No. of Wells	Zone	Oil, Bbl.	Water, Bbl.	Water, Per Cent.
25	A	1,433,173	496,417	20.5
9	B	1,226,856	224,002	11.3
26	C	2,175,550	211,995	38.0

Per cent water means the percentage of water in the fluid, fluid being the mixture of water and oil.

It would be expected that the failures to exclude water would be greatest at the greatest depth. This is found to be true, but Zone B has a greater percentage of success than Zone A, which lies above it. The explanation of this is that there is a more favorable structural condition between the water sand and Zone B than above zones A and C.

It is readily seen from the conditions outlined that one of the most serious problems in California operations is the control of underground water. The operators have been fortunate in that the men who have been called upon to solve these problems have been drawn from all the fields of the world. Broad experience and the breadth of vision to meet new conditions with new methods or adaptations of old methods have solved many trying situations, and the outlook for future progress is encouraging. The technology of all branches of the oil industry is advancing, and none more rapidly than that appertaining to underground operations.

Four types of water must be excluded: top, intermediate, bottom, and edge. Top water is water

originating above the first oil horizon. Intermediate water is water originating between oil sands. Bottom water is water originating below the lowest oil sand from which the well is producing. Edge water is water in an oil sand following the oil, and may appear in one oil horizon while other oil horizons are still productive. Should water appear in the second oil horizon while the first and third are productive, it would be an edge water in its own sand, but an intermediate with respect to the first and third.

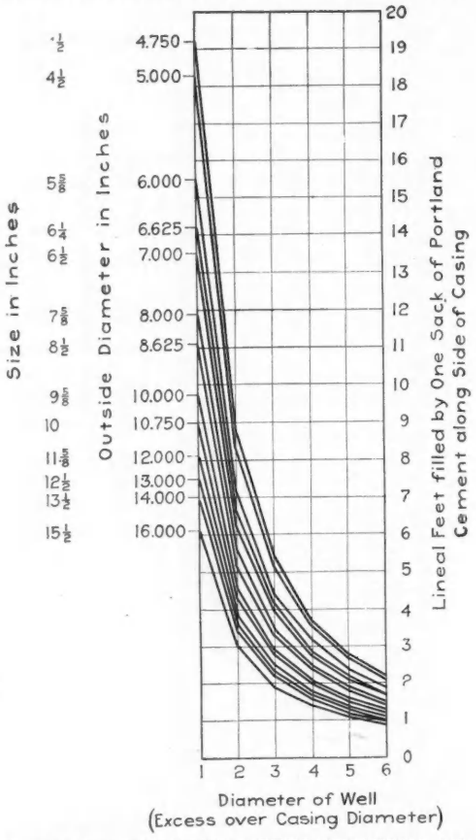


FIG. 1. GRAPH FOR THE DETERMINATION OF NEAT CEMENT FOR DIFFERENT CASINGS

The migration or movement of water from one formation to another is prevented by one or all of the following methods: formation shut-off, cementing, or the use of mud-laden fluid.

FORMATION SHUT-OFF

A formation shut-off is attempted when the casing is tightly driven into, or landed, in shale or clay, without the use of a packer or cement. The success of this method depends upon the selection of a shale or clay stratum as a landing for the casing. Shale or clay offers the greatest probability of being impervious to water. If possible, correlative data should be gathered to show the location and probable thickness of the best landing stratum. If this is not possible, the drilling should be closely followed and the casing landed too high rather than at such depth as to involve a chance of encountering a productive sand before having shut off the water. It is always possible to go back and ream the hole to size if a lower landing stratum is found.

When the place selected has been reached, the operation consists in drilling a smaller hole, 10 to 20 ft. in advance, and driving the casing into it. It is not good practice to raise the string of casing 20 ft. or more and let it drop free, to sink by its momentum into the formation. This is too severe a shock for any casing. The driving should be done with driving clamps, and an experienced driller knows when to stop driving.

A plain or tapered casing shoe is used, the length depending on the thickness of the landing stratum. A tempered steel tapered shoe is best, as it will set more firmly and withstand corrosion longer. When the casing has been landed, the hole is deepened 5 to 10 ft. ahead of the casing shoe, and bailed for testing the effectiveness of the shut-off. Care should be taken not to bail below the collapsing point of the casing. It is best to allow a safety factor of two in determining the resistance of the casing to collapsing pressure. The water level is known from the level to which the water rose in the casing while drilling.

If the bailing test shows no water coming in, the Mining Bureau is notified to send an inspector to witness a second bailing test, which is made at least twelve hours after previous bailing. If the test is satisfactory, the shut-off is approved; if not, the operator and the Mining Bureau agree upon a plan of operation to remedy the failure. If the total depth of the hole is not too great to allow bailing to bottom, the most satisfactory test can be made by bailing dry. The collapsing strength of casings is shown in Table V.

TABLE V. COLLAPSING PRESSURES OF CASING

Size, In.	Weight per Ft., Lb.	Inside Diameter, In.	Collapsing Pressure per Square Inch, Lb.	Equivalent Water Column, Ft.	Water Column With Safety Factor of 2 Ft.
4¼	16	4.082	4,710	10,850	5,425
4½	12.85	4.506	2,900	6,680	3,340
4½	15	4.424	3,610	8,320	4,160
6¼	20	6.049	2,380	5,480	2,740
6¼	24	5.921	3,220	7,420	3,710
6¼	26	5.855	3,650	8,410	4,205
6¼	28	5 791	4,070	9,380	4,690
8¼	28	8.017	1,670	3,850	1,925
8¼	32	7.921	2,150	4,950	2,475
8¼	36	7.825	2,630	6,060	3,030
10	40	10.054	1,420	3,270	1,635
10	45	9.960	1,800	4,150	2,075
12½	40	12.438	500	1,150	575
12½	45	12.360	750	1,730	865
15½	70	15.198	790	1,820	910

CEMENT SHUT-OFF

A cement shut-off is the operation of sealing between the formation and the casing shoe by the use of hydraulic cement. There are two methods of cementing, with many variations of each.

Dump-Bailer Method—The same operations are followed in the dump-bailer method of cementing as in the formation shut-off up to the time of cementing. The shale or clay landing stratum is chosen, and a small hole drilled ahead 10 to 20 ft. When ready to cement, the bottom of the hole is bailed clean of cuttings, and the casing is raised about 18 in. off the bottom of the full-sized hole. Enough cement must be used to fill the small hole and to flow up back of the casing 20 ft. or more. A sack of cement is figured as 1 cu.ft., and, when mixed with water to the consistency of gruel, will be increased to 1¼ cu.ft. A graphic illustration of the amount of neat cement required to fill the space back of the different sizes of casings is shown in Fig. 1. The usual amount of cement in practice varies from 8 to 75 sacks, and the amount necessary can be determined only by the size of the casing, the condition of the hole, and the depth of the small hole.

The cement is dumped into a shallow rectangular tank in such quantities as to fill the bailer to be used. The bailer may be either cast iron or glass bottom, with a moving plug below, which breaks the bottom

when landing, or it may be a trip-valve bottom, to drop its load, rather than to pick up a load as the usual bailer does. The glass or cast-iron bottom bailer can be used only when cementing on a plug or bridge, or original bottom with no small hole drilled ahead. When ready to cement, the bailer is lowered into the casing with its top just below the top of the casing.

The tank for mixing cement is set close to the top of the casing, with the back end raised and a pipe leading over the casing to discharge into the bailer. The cement is mixed with water, no sand or rock being used, and when thoroughly mixed it is emptied into the bailer. The bailer is lowered to the bottom of the hole and its load dumped. If more than one bailer load is used, the procedure, as outlined above, is repeated until the entire charge is dumped. The casing is now lowered to the bottom and driven into the formation.

The depth driven will be governed by the good judgment and experience of the driller. Should it be desirable to force the cement along the outside of the casing above its natural level, the casing is raised 20 to 30 ft. off the bottom. It is then filled with water and a plug screwed on the top, and the casing then lowered to position. As the water cannot leave the casing at the top, the cement is forced ahead of the lowered casing and travels up the sides of the hole.

Should a condition be met where the water runs off into some formation, so that the casing cannot be filled, it becomes necessary to use a cement plug, unless the pressure method is substituted for the dump bailer. Several kinds of plugs are suitable for this purpose, and they work on the principle that, when lowered below the bottom of the casing, a portion of the plug expands so that, when the casing is lowered to the bottom, the expanded plug acts as a seal and prevents the cement from entering the casing. These plugs are of cast iron and are easily drilled out when the cement has set.

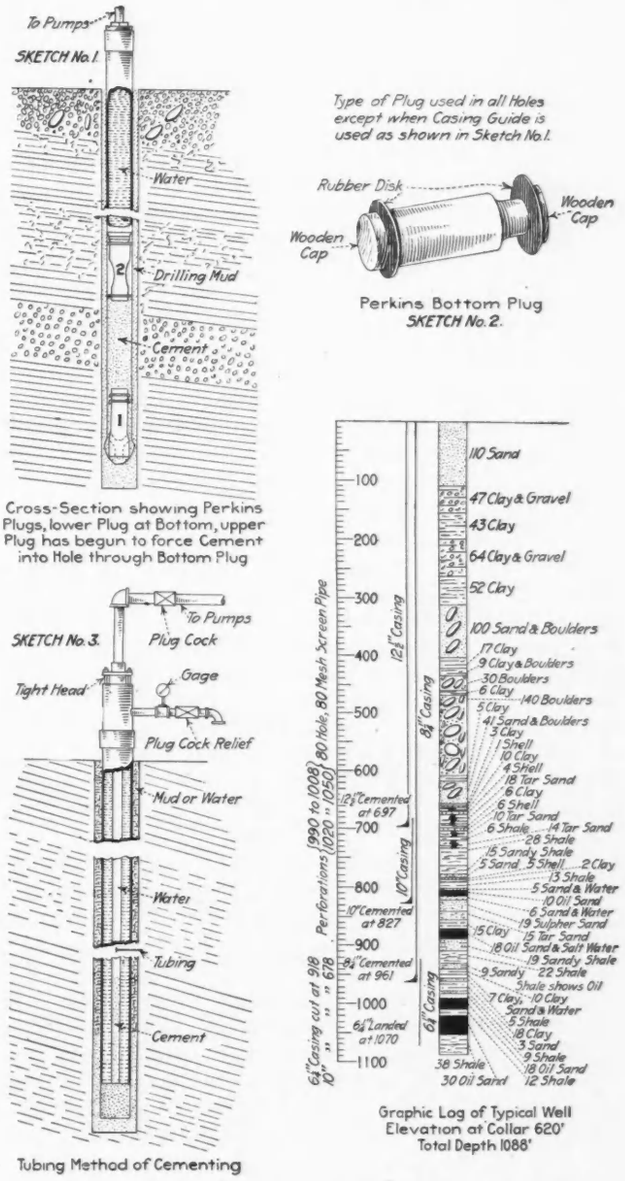
The hole is allowed to stand idle a week or more, the time generally depending upon whether or not the drilling crew can be kept at work elsewhere while the cement is allowed to set. When ready to test, a hole is drilled ahead of the shoe for 5 or 10 ft., and the same test is made as in the formation shut-off.

Cementing by Pressure—The pressure methods are known by the names of the inventors, or by the means of placing the cement, and are called the Perkins, the Huber and Wilson, and the Scott and tubing. The Perkins method is that used by the inventor after whom it is named. Equipment is maintained in the principal fields of California, with an operating crew for each unit. The charge is $250, regardless of the depth of the shut-off or the quantity of cement used.

The equipment consists of two pumps for handling cement and two rectangular mixing tanks, which are built to nest one within the other. One pump will operate up to 300 lb. pressure and the other up to 1,000 lb. The pumps are mounted on a motor truck, behind the driver's seat, and the tanks carried behind the pumps. A small box, to act as a sump, is also furnished. The contractor furnishes two wooden plugs, the equipment described, and the labor of two men, the owner of the well furnishing everything else—cement, steam, water, and all additional labor.

Upon arrival at the well, the steam line from the drilling boilers is connected to the pumps. A hole is dug and the sump box placed with its top level with the ground. The suction lines of the pumps and the main water-supply line are run to the sump. After the mixing tanks are unloaded from the truck, they are set up to discharge into the sump. Two tanks, each of a capacity of about 500 gal., are filled with water, and are also connected to the sump. The discharge line of the pumps is connected to the casing head by a long swing joint. This is to allow movement of the casing while cementing, in order to keep it free in the hole.

The drillers first secure circulation. By circulation is meant fluid pumped into the casing passes down



SKETCHES NOS. 1, 2 AND 3; GRAPHIC LOG OF TYPICAL WELL

inside the casing and returns up between the casing and the wall of the hole to the surface, or passes into some formation before reaching the surface. The casing is then lowered to bottom. A rise of pressure on the pumps will show that the landing is tight and the casing does not leak.

It is necessary now to describe the two plugs which are to be used. One plug precedes the cement down the casing and the other follows the cement; both are

made of redwood. No. 1 plug is put in the casing after circulation has been obtained, and the casing raised 18 in. off the bottom. This plug is 3 ft. long, and at its lower end is ½ in. smaller in diameter than the casing in which it is to be used. This diameter is maintained up the plug 9 or 10 in., at which point it is reduced about 3 in. for the remainder of its length. At the upper end, the plug consists of two wooden disks, which unscrew by means of a wooden screw in their center, which is right-and-left threaded to retain it in the body of the plug. Between the lower wooden disk and the plug a rubber disk, just the diameter of the casing, is placed; the wooden disk is screwed on, and another rubber disk placed above it. The second wooden disk is then screwed on top of the second rubber disk. (See Sketch 1, Plug 1.) Thus the plug has two rubber disks firmly seated, which prevent the cement above them from passing down and the water below from coming up, and which, when the plug reaches bottom, will bend downward, allowing the cement to pass. In the large portion of the bottom of the plug, a hole is bored upward which meets two holes bored diagonally downward, from opposite sides, forming a Y. The upper parts of the Y, or inlets, of these holes enter the plug in the reduced portion, thus making a passage through the bottom of the plug for the cement to pass when the plug reaches the bottom.

The type of bottom plug just described is used when lowering the casing into a rotary hole with an egg-shaped casing guide, as shown in Sketch 1. The plug shown in Sketch 2 is the type of bottom plug used when lowering casing with a plain shoe into a standard hole.

After the plug is in the casing, the casing head is screwed in place and connected to the pumps. By this time the cement has been mixed and is now discharged into the sump as rapidly as the low-pressure pump will pick it up and force it into the casing. The volume of the mixed cement is known and also the lineal feet which it will occupy in the casing to be used. When all the cement has been pumped into the casing, the casing cap is removed and the second wooden plug put in on top of the cement. The casing cap is replaced and again connected to the pump.

A water meter is connected on the main supply line to record the amount of water consumed. As enough water must be pumped into the casing to replace its total contents, an accurate record of the water must be kept. The total volume of the casing less the volume of cement will show the amount of water required to land the first plug at the bottom, and the total volume of the casing will show the amount necessary to land both plugs at the bottom. The two tanks of water are kept full, to be used if the main supply line fails, and, in that case, the water used is computed from the size of the tanks.

The upper wooden plug is 36 in. long, with the lower end about 3 in. less in diameter than the casing. A rubber disk is placed on the lower end and acts as a guide. Above the disk, the plug is reduced in size to a point about 12 in. below the top. In the top is placed a rubber disk, with a wooden disk above it, and, on the top of that, a leather cup disk, such as is used on a deep well pump. This leather cup is placed so as to prevent any water above the plug mixing with the cement below it.

The water is now pumped into the casing as fast as the low-pressure pump will handle it. The meter is watched, and when the lower plug should reach bottom a rise in pressure should be noted on the pump gage, as the pumps are now forcing the cement and mud up the wall and the weight of the column of water in the casing is not equal to that of the mud and cement outside of the casing. From this point on, the pressure will rise more rapidly, and when the second plug lands on the bottom plug, there should be a sudden rise to 300 or 400 lb. pressure. The rise in pressure is more conclusive evidence that the plugs have come together than the meter readings of water pumped. If the meter fails, as sometimes happens, the pressure gage will show when the plugs have come together. Although the low-pressure pump may finish the work, it is well to use the high-pressure pump and hold the pressure long enough to be sure that the upper plug has actually landed and not temporarily jammed before reaching the bottom. The casing is then lowered to the bottom, a valve in the pump line close to the casing head is closed to keep the pressure on the casing, and the pump line disconnected.

If it be necessary to use 100 sacks of cement, and a third of it is left in the casing, all of the benefit of the shut-off may be lost when drilling out the cement remaining in the pipe. The jar of drilling out 50 to 100 ft. of cement may crack the bond between the casing and the wall of the hole. The cement is given a week or more to set, and the same tests of shut-off are made as in the other methods.

The tubing method, as its name implies, is the use of tubing as a means of placing the cement. It is common practice to use 2- or 3-in. tubing, such as is used in pumping a producing well. It is necessary to provide a tight head in the casing, so that the cement will pass outside the casing. The basic principle of a tight head is that of a stuffing box. In some cases the stuffing-box collar screws into the box without packing, instead of in the usual manner. This method is most successful when working under high pressure.

The tubing method is not applicable if there is a possibility of the casing freezing while lowering tubing and cementing. The most successful operators stand the tubing in the derrick before beginning operations, thus lessening the time required and consequently reducing the chances of the casing becoming tight by caving.

The drillers get circulation before starting the tubing in the hole. The tight head is slipped on the last joint of tubing, and, when the tubing has been lowered to the position it will occupy during cementing, the head is tightened around the tubing. Clear water is pumped in the tubing with the casing on bottom until the gage shows about 50 lb. pressure, thus showing that casing can be landed tight on bottom and has no leaks.

Before cementing, it is necessary to calculate the quantity of water necessary to fill the tubing, and the water-supply tanks should have a capacity sufficient to furnish this amount. The cement is either mixed as in the Perkins method, or in a mechanical mixer, and pumped into the tubing. When all the cement is in, the pumps are connected to the water-supply tanks, and the calculated amount of water is pumped into the tubing. When this has been done, all cement should be back of the casing, except that occupying the space between the lower end of the tubing and the bottom of the hole. The casing is now landed on the bottom, and the operation completed, unless it is desired to

leave very little cement in the casing, in which event the tubing is raised or lowered to the required point, the tight head loosened, and clear water pumped into the casing. This is continued until all cement above the lower end of the tubing has been flushed back to the surface, as will be shown by the water coming out at the collar of the casing.

If it is not possible to seat the casing on the bottom, either because of the presence in the hole of side-tracked casing, lost tools, or collar-bound casing, in which case the cement will return inside the casing, it is necessary to use a cement retainer. The Baker cement retainer is a device well suited to meet this condition. It works upon the principle of a check valve, which can be firmly seated at or near the bottom of the casing after the casing is in the hole, and cement can be pumped down through this check valve, but cannot return.

The Scott method is really a process of mixing, rather than of placing the cement, and can be used with any cement method, but it is principally used by W. F. Scott, of Taft, Cal., the inventor, in placing cement by the tubing method. The mixing equipment consists of a steam-driven cement pump, a steam-driven cement mixer, a small suction tank, and a water tank. All but the suction tank are permanently mounted upon a wagon or motor truck.

The cement mixer consist of a 6½ ft. length of 12½-in. casing, lying horizontally, and acting as a mixing barrel, in which revolves a shaft with radial blades. Above the working barrel, and discharging into it, is the feed hopper. Water is piped into the working barrel at the feed end by two pipes tapped into the plug which forms the end of the working barrel. One of the water inlets is on each side of the stuffing box of the drive shaft.

Upon arrival at the well, the equipment is connected to the steam and water lines. A small platform with steps is moved beside the mixer, and all the cement sacks are untied, being placed within reach of the mixing crew. As a ton (20 sacks) can be mixed in 2½ to 3 min. it is necessary that the cement be handled rapidly. The suction tank is placed on the ground below the discharge of the mixer, with the suction of the cement pump laid to it. The procedure from this point is similar to that described in the tubing method, the principal variation being that a relief valve is connected to the tight head. The purpose of this relief valve is to avoid the necessity of loosing the tight head when pumping clear water into the tubing, either before or after cementing.

The Huber and Wilson method can be used with any cement shut-off. Its distinguishing feature is the addition of a secret solution which it is claimed produces quick setting of the cement.

Of more than 800 shut-off operations, 89 per cent were successful. The cementing shut-offs do not show as high a percentage of success, but it must be borne in mind that cementing is attempted at greater depths, with correspondingly greater hydrostatic pressures to overcome. This is well illustrated by the data in Table VI. which shows the depths at which the respective methods were used.

The relative success of these methods at different depths with cable and rotary tools is shown to be in favor of the formation shut-off in cable-drilled holes above 2,000 ft., whereas the formation shut-off is not common practice with rotary tools above 2,000 ft. This is shown by Table VII.

TABLE VII. RELATIVE SUCCESS OF FORMATION AND CEMENT SHUT-OFFS

					Cable Landing			Rotary Landing		
Shut-Off, Depth and Method	Success	Failure	Total	Percentage Failures	Success	Failure	Per Cent. Failure	Success	Failure	Per Cent. Failure
100 to 1000 ft.										
Formation shut-off	57	8	65	12.3	57	8	12.3			
Cement shut-off	154	27	181	14.9	114	19	14.3	40	8	16.7
Totals	211	35	246	14.2	171	27	13.6	40	8	16.7
1001 to 2000 ft.										
Formation	15	1	16	6.2	14	1	6.7	1		
Cement	184	39	223	17.5	107	22	17.0	77	17	18.1
Totals	199	40	239	17.4	121	23	16.0	78	17	17.9
2001 to 3000 ft.										
Formation	22	2	24	8.3	2	..	....	20	2	9.1
Cement	179	40	219	18.3	70	8	10.2	109	32	22.7
Totals	201	42	243	17.3	72	8	10.0	129	34	20.8
3000 plus ft.										
Formation	..	..	..	....	..	..	....	..	..	....
Cement	90	23	113	20.4	67	15	18.3	23	8	25.8
Totals	90	23	113	20.4	67	15	18.3	23	8	25.8

In the Belridge Field, San Joaquin Valley, Cal., the underground conditions are so complex that one of the operators is combining all of the shut-off methods with fair success. For example, a formation shut-off may be made after mudding under pressure, or dump-bailer cement shut-off or pressure cement shut-off after mudding under pressure.

The hole is drilled by rotary to a point below the first tar sand, which is usually at a depth between 600 to 750 ft., 650 ft. being the average. From the surface to 500 or 575 ft. the formation is alternating shale, clay, sand, and boulders. The first indication of approach to the first tar sand is a thin stratum of very hard formation, known locally as shell. This shell is seldom more than 5 ft. in thickness. Following this will be a stratum of clay or shale, seldom more

TABLE VI. TOOLS, LENGTH AND DIAMETER OF CASING AND METHOD OF SHUT-OFF
California, All Districts, All Fields
July 1, 1917, to July 1, 1918

Diameter	15½ in.		12½ in.		11¾ in.		11 in.		10 in.		9⅝ in.		8¼ in.		6½ in.		4½ in.		Totals
Method R. = Rotary C. = Cable Depths, ft.	R.	C.	R.	C.	R.	C.	R.	C.	R.	C.	R.	C.	R.	C.	R.	C.	R.	C.	
100–1000	..	...	....	18f.	..	11f.	....	....	.....	16f.	...	5f.	....	11f.	..	3f.	...	1f.	65f.
	3c.	4c.	40c.	53c.	1c.	7c.	....	....	4c.	55c.	...	1c.	....	13c.	..	....	...	...	181c.
1001–2000	..	...	....	7f.	..	...	....	....	1f.	3f.	...	...	7c.	1f.	..	....	...	...	16f.
	..	1f.	31c.	51c.	..	...	2c.	....	54c.	50c.	...	1c.	....	25c.	..	2c.	...	...	223c.
2001–3000	..	...	....	.....	..	...	17f.	....	4f.	1f.	...	...	1f.	1f.	..	....	...	...	24f.
	..	...	10c.	.....	..	...	13c.	....	95c.	16c.	...	...	23c.	48c.	..	12c.	...	2c.	219c.
3000 plus	..	...	....	.....	..	...	1c.	....	19c.	1c.	...	...	10c.	44c.	2c.	33c.	...	3c.	113c.
Rotary totals	..	...	.....	.....	..	...	17f.	....	5f.	.....	...	...	1f.	.....	..	....	...	...	23f.
	3c.	...	81c.	.....	1c.	...	16c.	....	172c.	.....	...	...	40c.	.....	2c.	....	...	...	315c.
Cable totals	..	1f.	....	25f.	..	11f.	....	....	.....	23f.	...	5f.	...	13f.	..	3f.	...	1f.	82f.
	..	4c.	....	104c.	..	7c.	....	....	.....	122c.	...	2c.	....	130c.	..	47c.	...	5c.	421c.
Totals, rotary and cable	..	1f.	....	25f.	..	11f.	17f.	....	.....	28f.	...	5f.	....	14f.	..	3f.	...	1f.	105f.
	..	7c.	....	185c.	..	8c.	16c.	....	.....	294c.	...	2c.	....	170c.	..	49c.	...	5c.	736c.

f. represents formation shut-off; c represents cement shut-off.

than 10 ft. thick, with another thin shell stratum immediately below. The tar sand is usually next below the second shell. There are exceptions to this. It may be said that there are exceptions to everything in this field. There may be several shell strata between the depths of 200 ft. and the first tar sand, but a tar sand should be watched for under the first shell passed below a depth of 500 ft. From the first tar sand and to the bottom of the lowest oil horizon the succeeding tar and oil sands are so lenticular that they cannot be correlated further than two or three locations, 800 to 1,200 ft. apart. It is sometimes impossible to correlate from one location to another. The first tar sand can usually be correlated accurately and is the "marker" for cementing the first water string, which is 12½-in. casing. The 12½-in. casing is usually cemented with 160 sacks by the Perkins method.

The rotary is then moved to another location and the cable tools are rigged up, and a week or ten days are allowed for the cement to set. When ready to test the shut-off, the hole is drilled ahead by cable tools, about 5 ft. below the shoe of the casing, and then bailed dry, to stand 12 hours. The usual test is made in the presence of a Mining Bureau inspector.

Because it is impossible to foretell whether or not lower water sands will be encountered between the bottom of the 12½-in. casing and productive oil horizons, a string of 10-in. casing is carried as a possible second water string, and if sands are encountered they are tested for water. These sands may be tar, dry, or oil sands, in the adjoining wells, yet prove water-bearing in the new hole, or they may be dry in the new hole, though wet, tar, or oil in the adjoining wells.

Should water be found while carrying the 10-in. casing, it is landed for a temporary shut-off in the first suitable shale or clay stratum below the water sands. This shut-off may be formation, or the dump-bailer method. The 8¼-in. casing is then carried as a prospect string until it is known if the 10-in. casing should be carried lower for a permanent shut-off. When the 10-in. casing is cemented for a permanent shut-off, mud-laden fluid is pumped under pressure into all formations back of the 10-in. casing. If the 10-in. casing becomes a water string, it is between the depths of 780 and 825 ft. It sometimes happens that when drilling ahead to complete with the 8¼-in. casing, it also must be cemented for a shut-off and the hole completed with 6¼-in. casing, in spite of the fact that the average depth of the wells is between 1,000 and 1,100 ft. An example of this condition is shown in the accompanying graphic log. Attention is called to the fact that the two upper oil sands are shut off, as shown by the depth of cementing with 8¼-in. casing. The 10-in. and 6¼-in. casing are cut and pulled above the shoe of the next larger casing and adapters placed.

Portable Lamp Guard

The necessary repair work about mine hoist houses and boiler rooms can best be done in daylight and under such conditions as will permit of a full view of the part or parts that require attention. But this is not always possible, and it frequently happens that inaccessibility of parts allows little choice in the matter, and the work must be done in a cramped position and with little light. The latter condition prevails to a great extent in underground mine pump stations and repair shops, but, wherever electric connections are to be had, the difficulty may be partly overcome by the use of a portable lamp properly provided with a guard. The uses about the mine for such a device are not confined to the above-mentioned instances, for the portable lamp will be found invaluable in shaft work, motor-locomotive repairs, and under many other conditions where it is possible to obtain the necessary current for illumination.

In drifting and crosscutting where electric current is available a flexible cable and tungsten lamp, protected by a lamp guard, are used for illumination.

A successful portable lamp guard, which is quickly attached and fulfills all the requirements of durability and safety, is made by the Flexible Steel Lacing Co., of Chicago. It consists of a split handle attached to an expanded-steel lamp guard. The halves of the guard, including the handle itself, open wide from the hinge at the bottom of the guard and can be instantly closed and locked around the socket at the end of any extension cord.

Fuller's Earth in 1918

U. S. Geological Survey

Fuller's earth, which is used principally in filtering petroleum, was in good demand in 1918, and, in consonance with the increase in production of petroleum, showed a large increase in output, notwithstanding the handicaps of shortage of labor and fuel, and unsatisfactory conditions of transportation. A report on fuller's earth in 1918, by Jefferson Middleton, shows that the output in 1918 was 83,968 short tons, valued at $1,143,854, or $13.62 per ton, at the mine. This was an increase of 11,401 tons in quantity and $371,767 in value, compared with 1917, and was the largest output and the greatest value in the history of the industry. The output in 1918 was twelve times as great and the value twenty-eight times as great as in 1895, the first year in which fuller's earth was commercially produced in the United States. The average price per ton in 1918 was the highest on record and $2.98 higher than in 1917.

Deposits of fuller's earth are found in many states, but the deposits in only seven states were worked in 1918. Named in the order of output these states were Florida, Texas, Georgia, California, Arkansas, Massachusetts, and Nevada. Of the output in 1918 about 99 per cent came from Florida, Georgia, Arkansas, and Texas. Nevada appeared for the first time as a producer of fuller's earth. A large deposit of earth in Ash Meadows, Nye County, known as "Death Valley Clay," has been used experimentally in refining petroleum and is said to be excellent for this purpose. Florida, which has been the leading state in the production of fuller's earth since the beginning of the industry, reported about four-fifths of the output and value in 1918.

Though the production of fuller's earth increased in 1918, the imports fell off, owing to shortage of bottoms and high ocean freight rates. The quantity imported was 12,607 short tons, valued at the port of shipment at $165,535, or $13.13 per ton, a decrease of 4,387 tons in quantity and of $10,882 in value, compared with 1917.

The apparent consumption of fuller's earth—that is, the production plus the imports—was 96,575 tons in 1918, an increase of 7,014 tons, compared with 1917. The domestic production therefore constituted 87 per cent of the consumption in 1918.

Graphite Mining and Milling in Alabama

Adoption of Oil Flotation Is Responsible for Recent Progress Made in the Graphite Industry, And That Process Will Probably Supersede Other Methods of Concentration

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SINCE the appearance of an article[1] on graphite mining in Alabama, by Irving Herr, little has been published regarding conditions in this district, and, in consequence, it may not be as generally well known as its importance warrants. For the last two years there has been considerable local activity, the result being the establishment of what promises to be one of the country's important minor industries.

There are in Alabama large deposits of low-grade disseminated graphite ore that are easily mined. The graphite is of excellent quality and entirely of the crypto-crystalline variety, known in the trade as "flake graphite." Until recently the deposits were considered to be pre-Cambrian, but later investigations have demonstrated that they are of Carboniferous age, though the rocks are highly metamorphosed and consist entirely of quartz schists.

Dr. W. F. Prouty[2] describes[3] the district as follows: "The rock in which the flake graphite beds occur is a mica schist, generally considered of pre-Cambrian age, for the most part highly metamorphosed and much intruded by both acid and basic igneous rocks, which are for the most part in long dikes, nearly parallel with the trend of the graphite orebodies, but in some cases cutting them at slight angles. Some of the pegmatite dikes have excellent commercial mica and kaolin. Bordering this mica schist on the west, for the entire length of the area, occurs a green-colored schist, originally a basic igneous rock and designated by the Alabama Geological Survey as the Hillabee schist. The graphite area is seldom more than three miles distant from this metamorphosed basic igneous mass and locally is in contact with it."

The ore which is now mined consists almost entirely of the weathered portion of the beds, the weathering usually extending down to the water level in the valleys between the hills on which, almost without exception, the deposits are found, the valley bottoms being usually filled with soil washed down with other detrital matter from the higher ground. This weathered ore is soft and in most instances breaks down on quarrying, like sand. The whole is easily milled, the quartz being friable. The gangue consists entirely of a friable quartz with a small quantity of "a white fibrous mineral, probably sillimanite" and occasionally mica, either biotite or muscovite, cyanite, and tourmaline.

FLOTATION METHODS SUCCESSFUL WITH ALABAMA ORES

Until within the last two years, practically all the mills were equipped with "skin-flotation" machines, known locally as the "Ashland washer," a device identical with the Brumell hydraulic separator, used long ago and abandoned at Buckingham, Quebec. One of the mills obtained concentration by means of the Huff electrostatic machine and one adopted the use of a Minerals Separation oil-flotation machine.

Since 1917, and with the advent of the oil-flotation method of concentration, the industry in Alabama has made excellent progress, and this method seems to have solved the problem of cheap extraction. Many new mills have been erected, and a few of them have operated satisfactorily, the most successful being those wherein flotation methods were employed. The following is a list of the plants in the three counties of Clay, Coosa and Chilton, showing the method used at each:

ALABAMA GRAPHITE PLANTS AND METHOD OF CONCENTRATION.

Plant	Situation	Type of Concentration
Liberty Graphite Co.	Clay County	Callow
Lineville Graphite Co.	Clay County	Ashland
Carbon Mountain Graphite Co.	Clay County	Callow
Peerless Graphite Co.	Clay County	Remodelling
Jennings Graphite Co.	Clay County	Ashland
Republic Graphite Co.	Clay County	Ashland
Crystalline Flake Graphite Co.	Clay County	Log washer
Clay County Graphite Co.	Clay County	Ashland
Monitor Graphite Co.	Clay County	Callow
Cahaba Graphite Co.	Clay County	Ashland
Graphite Mills, Inc.	Clay County	Pneumatic tables
National Graphite Co.	Clay County	Ashland
Southern Graphite Co.	Clay County	Callow
Acme Graphite Co.	Clay County	Log washer
Ashland Graphite Co.	Clay County	Callow
Griesemer Graphite Co.	Clay County	Wet tables
May Brothers Graphite Co.	Clay County	Ashland
Alabama Graphite Co.	Clay County	Ashland
Alabama Graphite Co. No. 2.	Clay County	Log washer
Axton-Noe Graphite Co.	Clay County	Ashland
American Graphite Co.	Clay County	Minerals Separation
Quenelda Graphite Co.	Clay County	Ashland
Norway Graphite Co.	Clay County	Ashland
Eagle Graphite Co.	Clay County	Log washer
C. B. Allen Graphite Co.	Clay County	Callow
Jefferson Graphite Co.	Clay County	Callow
Atlas Graphite Co.	Clay County	Callow
Superior Flake Graphite Co.	Clay County	Brown
Crucible Flake Graphite Co.	Clay County	Ashland and Minerals Separation.
Hood-Graves Graphite Co.	Clay County	Ashland
Graphite Company of America.	Coosa County	Electrostatic
Goodwater Graphite Co.	Coosa County	Ashland
The Ceylon Co.	Coosa County	Minerals Separation
Parkdale Graphite Co.	Coosa County	Simplex
Diamond Graphite Co.	Coosa County	Simplex
Seminole Graphite Co.	Coosa County	Callow
Duro Flake Graphite Co.	Coosa County	Simplex
Flaketown Graphite Co.	Chilton County	Electrostatic

The superiority of the oil-flotation method of concentrating graphite over other methods employed has been demonstrated, and it is probable that all mills in the future will be equipped with one or other of the various types of machines on the market, or by flotation apparatus of home construction. The types so far used in Alabama comprise Minerals Separation, Callow, Simplex, Brown, and Janney, the latter only, up to the present, being used for purposes of re-cleaning. In those cases where the machine treatment is followed by the use of wet tables, either Wilfley or Deister, concentrates that assay from 80 to 88 per cent, with an extraction ranging from 83 to 90, are being produced. With all the types of machines the extraction is in inverse ratio to the size of the graphite particles in the pulp. Thus, the coarser the graphite, the poorer the extraction; and the greater the proportion of saving of the coarser material, the poorer the concentrates. There is opportunity here for expert mill practice, and the most successful operator will be the one who can best adjust the two conditions.

[1] *Eng. and Min. Journ.*, Apr. 21, 1917.
[2] Assistant State Geologist, University, Alabama.
[3] *Birmingham Age-Herald*, Jan. 28, 1917.

It is not the intention to criticize or compare the methods of mechanical or pneumatic agitation, but, in a general way, it may be positively stated that the machine which affords the greater time for the settling of the froth will give the highest percent concentrates, whether the froth be made by one or the other method. In the matter of the recovery of the coarse flake, the question of froth settling is a serious one, as any agitation sufficient to lift the heavier graphite will lift considerable gangue, and, if quick delivery is made, poor concentration will be the result.

Prior Oiling of Pulp Secures Good Results in Ball Milling

In general practice, various crushers are used, both jaw and gyratory, and the crushed ore is, in some instances, further reduced by rolls before going to the ball mill, to which it is fed after oiling. The emulsification of the water before the ball-mill treatment tends to save the freed flake, as the revolving and churning action of the mill creates a froth, which carries the graphite through on the surface of the charge, leaving only the coarser particles of ore to be ground. It was feared that the use of ball mills would prove to be so destructive of the flake as to be inoperative, except for the making of fine flake and dust, neither of which is desired by the producer. But experience has proved that with prior oiling of the pulp, and with care in adjustment and operation, excellent results can be obtained.

The ball mills in use in the district comprise Marcy, Hardinge, Lehigh, and Marathon types. Various classifiers, including the Dorr, Atkins, Gemmell, and Deister, are in use. Heretofore little attention has been given to the operation of classification, and the machines were used entirely for the purpose of returning oversize to the ball mills. It is, however, thought that with proper adjustment a large proportion of barren material might be removed and full advantage taken of this important operation. With an ore in which the graphite separates easily, there is no reason why at least 50 per cent of the gangue should not be eliminated.

Graphite Treatment Following Concentration

After concentration is effected, the concentrates are dried and sent to the finishing plant, where the usual methods of refining or finishing are followed. At most of the mills some type of air classifier is used, either an aspirator or apparatus of home construction, and two of the mills use high-speed smooth flour-mill rolls, the action of which is to crack the coarser gangue particles, the consequent dust being removed by screens clothed with silk belting cloth. At one of the latter mills the concentrates were improved from 71.8 to 85.7 per cent and in the other from 51.0 to 82.0 per cent carbon.

After treatment, as above, the finished concentrate goes direct to the buhr mills, where it gets a final grinding and polishing and is then graded for the market, Alabama stocks being known as No. 1, No. 2, No. 1 dust, and No. 2 dust. It has not been found possible to obtain sufficient representative assays from which to make an average, but it may be stated, in a general way, that the average of No. 1 would be about 88.0 per cent carbon, and of No. 2 about 82.0, and both qualities of dust would range from 30.0 to 50.0 per cent pure graphite.

As an evidence of the freedom of Alabama graphite from deleterious substances, more especially iron, lime, and mica, the following complete analysis, a composite of several analyses, is presented, and for comparison an analysis of the Ceylon material. Both analyses are official, being taken from a report by George D. Dub, "Preparation of Crucible Graphite," U. S. Bureau of Mines, 1918:

COMPARATIVE ANALYSES, ALABAMA AND CEYLON GRAPHITES

	Alabama, Per Cent.	Ceylon, Per Cent.
Volatile carbon	1.89	1.68
Graphite carbon	87.03	85.06
SiO_2	5.85	7.81
Al_2O_3	4.17	2.82
Fe_2O_3	0.38	1.61
TiO_2	0.15	0.13
CaO	....	0.19
MgO	0.13	0.21
K_2O	0.21	0.25
Na_2O	0.04	0.11
SO_3	0.04	0.005
P_2O_5	0.02	0.05
MnO	....	0.04
ZnO	....	0.03

Bureau of Mines Experiments and Future of Alabama Graphite Industry

Considerable experimental work has been undertaken by the Bureau of Mines, with a view to ascertaining the relative value of Alabama crucible stock as compared with that of Ceylon, which has hitherto dominated the markets of the world. The investigations have proved the stocks for crucible making to be of a parity, and the fact that during the period of embargo on foreign graphite there was no dislocation of the crucible industry, which was forced to use both domestic clay and graphite, would further tend to prove this.

In conclusion it may be stated that Alabama has extensive beds of low-grade ore, easily mined and milled and possessing all the elements necessary to the success of the industry, such as available labor and shipping facilities, so that its permanent establishment and extension are solely matters of proper business organization and management. The industry is not, in the true sense, a mining one, but is rather a milling proposition, and, as such, will become standardized as are other industries.

Crushing Practice at Anaconda

At the concentrating mill of the Washoe Reduction Works of the Anaconda Copper Mining Co. the run-of-mine ore is roughly screened over a shaking screen with 2-in. round holes, the oversize going to a 12 by 24-in. Blake-type crusher set to 2 in. The crushed product is sent over a stationary grizzly with 2-in. openings, the oversize going to two 8 by 20-in Blake-type crushers set to 1 in. The product of the 8 by 20-in. crushers joins the undersize of the shaking screens and is delivered to a series of trommels. The first trommel has 1-in. round holes, the oversize going to one set of 55 by 24-in. heavy-duty rolls set to about ⅝ in., the crushed product being sent back to the trommel line. The undersize from the 1-in. trommels passes to the ⅜-in. trommels, the oversize being sent to one set of 55 by 24-in. heavy-duty rolls and back to the head of trommel line. These rolls are set to about 5 mm. All material crushed through ⅜-in. is further sized and jigged. The jig tailings are then partially dewatered and sent to 1½ by 12 mm. trommels operating in closed circuit with two sets of 55 by 24-in. heavy-duty rolls, where the crushing process is completed to 1½ mm.

War's Influence on the Zinc Industry*

The Meeting of the Zinc Institute at St. Louis an Occasion for Special Emphasis Upon the Development of New Uses for Zinc and Co-operation Between Miner and Smelter

BY POPE YEATMAN
Consulting Mining Engineer, New York

I FEEL greatly honored to be called to this, my native city, to speak to you of the zinc industry, for it was in zinc mining that I spent my happiest, early professional days. Our job is to look forward not backward; to make history in the zinc industry, not to live in the past, considering what "might have been." On the other hand, a study of what has been done, or might or should have been done, may be helpful in the consideration of the future.

Though we do not look on zinc as a "war baby," from a purely selfish and materialistic point of view, the war ended too soon for the zinc industry, not so much on account of the lessened demands for the metal for munitions, as in the line of building up new uses for zinc and therefore new requirements, and a better co-operation of the mining and smelting interests, with a breaking down of old-time antagonism and distrust.

This society of ours can and should be of great assistance in these directions, and it should be aided in every way possible by its members in the future. We need a continuance of the enthusiasm of the directors whom we now have, backed by the loyal support of our membership.

BEGINNINGS OF CO-OPERATION

As you know, just before the armistice was declared, a distinct evidence of co-operation of the miners and smelters was being displayed—of co-operation not against the Government, or in "restraint of trade," but helpfully to further the legitimate interests of the trade.

Quoting Edgar Palmer, president of the New Jersey Zinc Co., regarding an agreement to be entered into: "The proposed plan is designed to bring about closer co-operation between the zinc-ore producers and the zinc smelters. Such a stabilization of the zinc industry is a matter of national importance." The negotiations were, I believe, to have been handled by the Zinc Institute. The numerous conferences have produced a greater feeling of trust on the part of both miners and smelters, and the miners have learned more of the conditions under which the smelters have had to operate; so, as always happens with better knowledge, there is less apt to be misunderstanding between the two interests in the future.

NEED FOR PUBLICITY

We are more and more being drawn to the belief in the doctrine of publicity. A condition of secrecy causes distrust and dissatisfaction, whereas publicity produces a better understanding, and results in greater co-operation and pursuit of common interest. In the old days, it was the custom in metallurgical establishments to keep everything secret, to hold as an asset some process of which it was believed others knew nothing, and to struggle along and grope about while seeking knowledge others had. This is now largely altered, and there is a fine exchange of ideas and methods, to the advantage of all. Secret processes do not remain so for long.

During the period of the European war, the zinc industry passed through many phases: from normal conditions, through a period of expansion or inflation, during which time there was an abnormal increase of production, by reason of more mines being operated, as well as a great increase in smelter capacity; thence, as a result of overproduction, back to prices which, though higher than in the pre-war period, were nevertheless not unreasonable when compared with the advances in costs; and now back to a condition of low demand, with higher costs than those prevailing prior to the war.

The inflated prices were by no means an unmixed blessing, for they caused an increased production beyond possible requirements, and the operation of properties which under normal conditions could not be worked at a profit, resulting in a depression of the trade which always follows periods of great and rapid expansion. The zinc-smelting capacity of this country, as well as of the world, is much in excess of normal demands.

ANTAGONISTIC FEELING BEFORE THE WAR

Previous to the war, the relations of the different branches of the zinc industry, one to another, were by no means ideal. There always had been a more or less antagonistic feeling between the smelter and the miner—not only antagonistic but distrustful. It was almost as bitter as the feeling in a long-drawn-out lawsuit, where each of the contending parties feels that he is in the right but cannot see anything good in the case of the other, and, being a partisan, energetically hates and despises his opponent.

Between the different smelters, owing to competition, there was also antagonism; in fact, the whole industry was noted for the lack of co-operation on the part of those engaged in it. Nor, as a whole, was the business a progressive one. There was no community of interest, the main aim of the interested parties being in their own particular business, regardless of the fact that anything done for the benefit of the many might also be of advantage to the few.

It was under these very unfavorable circumstances that the War Committee, appointed by the different branches of the industry to aid the Government, started in. However, immediately after our Government joined the Allies, things changed for the better. It was the object of the War Industries Board, with which your committees and individuals of the industry co-operated, to aid in every possible way the object in view of bringing out a production adequate for the war needs of the Government and, so far as possible, to supply

*An address at the American Zinc Institute Meeting at St. Louis, Mo., on Monday, June 9, 1919.

the commercial needs where to do so would not interfere with the conduct of the war.

It was also the object of the Government to interfere as little as possible with the conduct of the industry, and for this reason the Government officials opposed the fixing of maximum prices except in the case of two products which it seemed essential to stabilize. They endeavored to avoid runaway markets, as well as to prevent prices dropping so low as to cut off the steady and necessary production required, the effect of runaway prices being an excessive production, followed by closing down of properties due to inability to dispose of the product, and resulting later in too little production to supply the demands. Instead of a steady and stable production, this rising and falling of prices proves demoralizing, especially during a period of war.

The two products on which a maximum price was fixed were high-grade zinc and sheet and plate zinc. These maximum prices were fixed high enough to stimulate production by giving some assurance to the producers that the Government regarded these prices as fair under the circumstances, and in order to remove from their minds a possible fear of lower maximum prices being fixed in case the prices were left open.

The amount of high-grade zinc which could meet the Navy requirements was not equal to the demand, and it became necessary to increase the output by re-distilling spelter and by arranging for the use of high-grade metal not quite equal to Navy specifications, for the manufacture of grades of brass for which the very highest grades of spelter had previously been required; and in the case of rolled sheet and plate it was believed that the existent plants would not be able to turn out the quantity necessary, so that the expansion of rolling mills was necessary, and to bring this about a tempting price for the finished product would be required. It is believed that the plan worked out satisfactorily.

During War Normal Uses Were Restricted

During the war, the normal uses of zinc were greatly upset and altered, with increased utilization in one line and almost complete lack of demand in another. For instance, the demand for high-grade spelter for shells was greater than ever known, though the use of spelter for galvanizing was not only diminished but practically wiped out. In the future, there will be little demand for brass for shells, for the business of war for many years to come will, we hope, be done away with. Unfortunately, during the war many substitutes were found to replace galvanized iron, the principal manufactured product for which spelter was previously used, and the use of these substitutes will undoubtedly be largely continued.

Spelter being plentiful, it was found necessary, in order to keep up the output, to find other uses for this metal, and in this direction the most promising field lay in substituting zinc for metals which were either very much more expensive, or in which there was a shortage. Among these may be mentioned the replacement by zinc of tin, aluminum, brass, and other alloys.

The Conservation Division of the War Industries Board, with the Zinc Section, evinced great interest in this direction, and a start was made in getting the manufacturers to substitute zinc for other materials in rather a large way. Some of your own companies also interested themselves in a practical manner, and this not selfishly, in keeping to themselves, but freely giving of their information to the industry as a whole.

I said "unfortunately for the zinc industry, the war ended too soon," because I believe that through the agencies of the Government further uses for zinc were being inaugurated, and that after experience with this product the public would wish to continue its use. We know it is a hard thing to change precedents and to alter well-tried and successful plans and introduce something else, unless there are some spectacular features connected with it—something that might help as an advertisement. In the case of many of the manufactured products in which, for instance, tin or other rather high-priced metals were used, zinc could be substituted. It was, however, with the practical certainty of reverting again to the original metals after the embargo on these had been raised. However, zinc could have been substituted for other metals in a great many products with the certainty also of a continuance of its use.

New Uses for Zinc

There has been scarcely time in which to prove this plan to be good, and now persuasion will have to be employed in place of the so-called "force," which was really an appeal to patriotism. The list of articles in which zinc could be substituted for other metals is, to use a common expression, "as long as your arm." Many of these amount to but a few thousand pounds per year, though others aggregate thousands of tons.

It was the view of the Conservation Division of the War Industries Board that, to quote from one of their reports:

> The possibilities of increasing the uses of zinc are very large, particularly in the case of rolled sheet. In this country the rolled zinc produced has never been more than 10 per cent of the production of spelter, though on the Continent of Europe many of the largest producers roll 50 per cent to 100 per cent of their output.
>
> The largest tonnage uses of sheet zinc in Europe are for roofing, cornices, architectural ornaments, gutters, leaders and flashing, all of which are more durable when made of zinc than when made of galvanized iron or tin plate, as is usual here. In all of these cases painting is unnecessary, except where desirable for decoration. In the few cases where zinc roofs have been used in this country they have remained in good condition for forty or fifty years, though entirely unpainted.
>
> Zinc, both cast and rolled, can be substituted for other metals in many cases. Possibly the increased use of castings is even more important.

Though the business is an old one, few of those engaged in it have known in a more than rudimentary way the real value of zinc, and few, if any, have taken any active interest toward increasing its use, devoting their time mainly to disposing of their own individual product to the best possible advantage, but doing practically nothing toward building up the business as a whole; growling because the market was limited, but leaving to others the increasing of the markets—but, practically speaking, there were no others.

The Example of Aluminum

One of the best instances of building up trade for an industry which started on the smallest basis is that of aluminum. When aluminum was first manufactured, the cost was high and there were very few uses for the finished product. As it became possible to manufacture more cheaply and in greater quantity, it was found necessary to produce a market, and this was systematically done. This feature became just as im-

portant a part of the business as the production itself.

The largest producer of aluminum carried out a broad and comprehensive program of manufacturing finished products and introducing them to the public, in the way of cooking utensils, containers, instruments, sanitary appliances, sheet aluminum for automobile bodies, cast aluminum crank cases, aluminum wire for conductors, electrical appliances, and in other like applications, and also for alloys, the utilization of which had to be brought to the public's notice, such as employing aluminum in the manufacture of steel, and for paint and other utilitarian purposes.

In introducing the metal, the aluminum company was obliged to exercise the greatest care to see that its products were used under proper conditions, and on many occasions declined to sell to those who wished to employ the metal for purposes for which it might not be suited. The producers of nickel also went through a similar experience in order to make a market for their product, which started with a small demand. Certain uses of zinc have been taken for granted, and the miners and smelters have sought to supply only these particular uses; but that is really a small part of what is possible. The more one studies the proposition, the more one feels convinced of the possibility of increasing the needs for this metal. What has been done with aluminum and nickel can be done with zinc.

Proposed Propaganda

We do not like to use the word "propaganda," because it has been associated with so much that was sneaking and underhand, but a campaign of "propaganda" in its best form should be inaugurated by the zinc industry. It will be necessary to educate consumers and possible users in the advantages of spelter over other metals for certain uses, and to let them know for what new uses the metal can be employed.

Get samples of different manufactured-zinc products to show the builders, architects, dealers, and general consumers. Explain by means of literature, and by "spielers" for zinc, sales engineers, and traveling men with samples, the advantages of the zinc articles, and remember that while this program may help certain manufacturers more directly than it may the majority of you, it will build up the industry generally and so help the individual, whether miner or smelter.

First have the matter studied scientifically by research, experiment, and demonstration; then advertise for all it is worth. You have a good thing—do something with it. Do not leave it to one or two companies to exploit, but work it up by the industry as a whole. To recover in volume the old uses for zinc, such as for galvanizing and for paint, should also be an object of great endeavor. The increasing of demands should not be the only aim, for there is great promise in improving metallurgical methods, as has been emphasized by W. R. Ingalls. Zinc smelting has been backward, more so than the metallurgical treatment of other metals, and it is believed, by those who are in a position to be judges, that there are great possibilities of improvement in this field.

Utilization of Byproducts

The utilization of byproducts should also be pushed, in order to cut down the cost of the main product—zinc. Of course, in many smelteries the sulphur from blende ores is utilized for the manufacture of sulphuric acid. Attempts should also be made to utilize that much-abused metal cadmium, which can in part be substituted for a portion of the tin in certain alloys. High prices are not so much required as low costs of production, with an increased spread between price and cost; in other words, greater profit; for the lower the average price—other things being equal—the greater the chance for increased consumption, the larger the volume of zinc produced, and the greater the volume of profit.

Really the most important thing that materialized in the numerous meetings at Washington and elsewhere was the bringing together of old-time interests which previously had been battling, and the birth of a more friendly and helpful feeling. This was made possible by the fact that every one was stirred by a spirit of patriotism, which made him willing to sacrifice his individual material or business interests if necessary, just as his sons and brothers were willing to sacrifice their lives for the good of their country. It made him more unselfish and more willing to help his neighbor, and it brought into especially strong relief the virtues of each individual man.

We know that there may be individual business men who may not be thoroughly unselfish; that with many it has been "every man for himself and the devil take the hindmost," but from the moment our Government entered the war the men of the zinc industry have truly "played the game," and no criticism can be made of any display of selfishness, lack of patriotism, or unethical conduct.

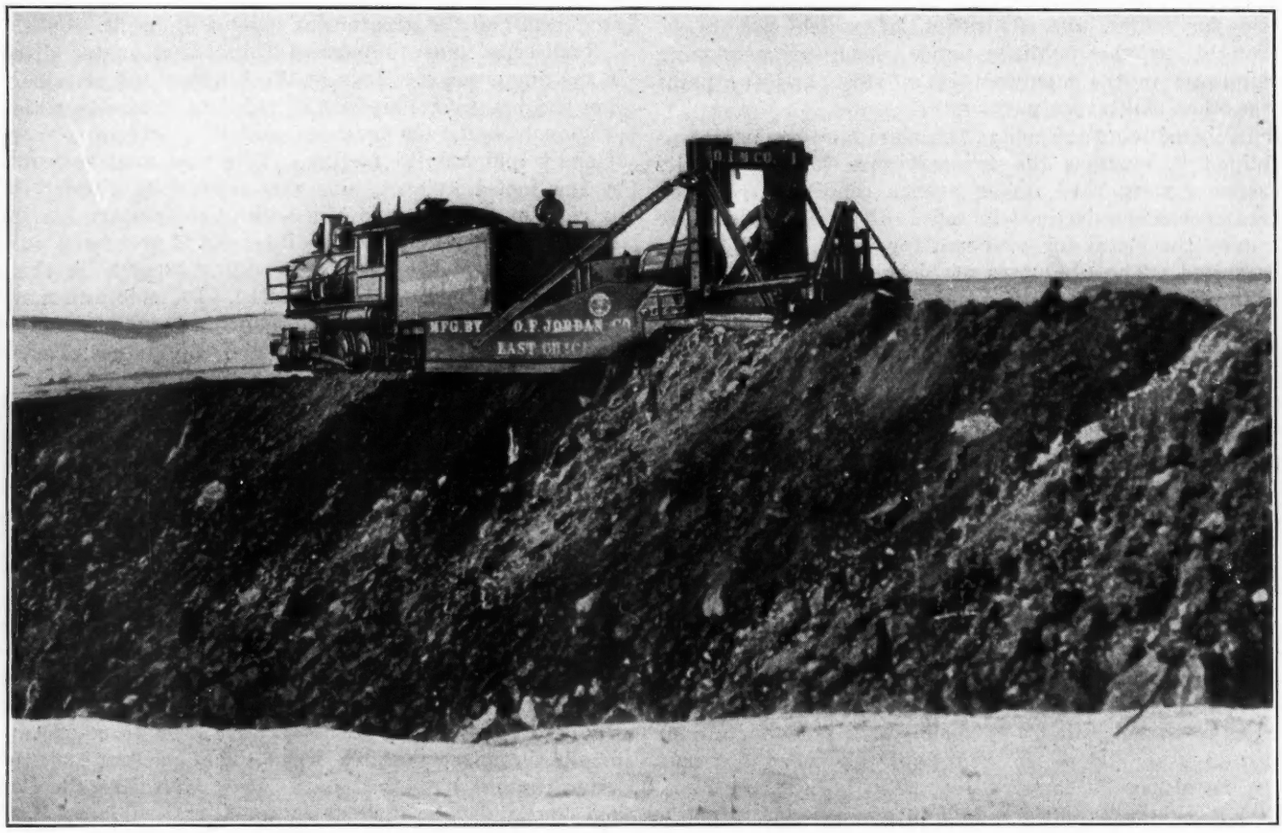
Everyone has been willing to help; everyone has wanted to have the industry meet its requirements; and everyone has had a pride in the business as a whole, and has been anxious for it to do its part. Men who had never pulled together were keen to co-operate in the broadest possible way. The smelter and the miner walked hand in hand: They were like the lion and the lamb who "lay down together." I leave it to you, however, to decide which was the lion and which the lamb.

The miner began to think that the smelter official was a pretty good fellow after all, and the compliment was returned by the latter. I do not know how often I have heard the remark: "Why, I thought So and So was a pretty hard nut, but now I have seen him and talked with him, I find he is a pretty good chap after all."

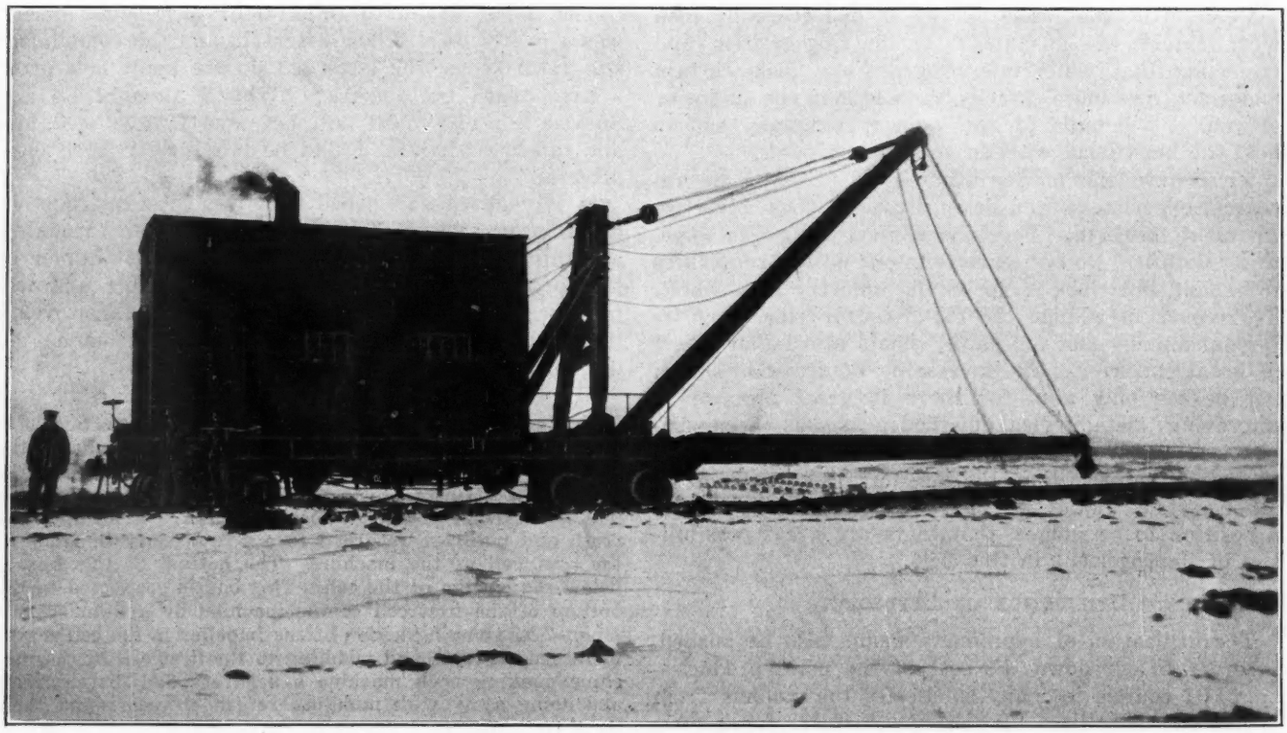
It is believed and hoped that this meeting together of different interests, resulting in a better "acquaintanceship"—a word made famous at the last dinner of this organization—will have a lasting effect and will produce a condition that it would have taken years to have accomplished in such a thorough manner in normal peace times.

No Important Improvements in Flotation Practice have taken place during the last two years at Anaconda in the kind or method of use of flotation agents. At present, the launder system attached to the spitzkasten of each flotation machine is being rebuilt in such a manner that all middling froth and pulp are returned to a box directly in front of the first cell of the machine. The bottom of this box is below the bottom of the cell. This box is connected to the bottom of the first cell of the machine by a 6-in. suction pipe. The pumping action of the impeller in the cell serves to return all froth and middling to the first cell of the machine, making each machine a separate and distinct unit and doing away with middling return elevators and their necessary upkeep.

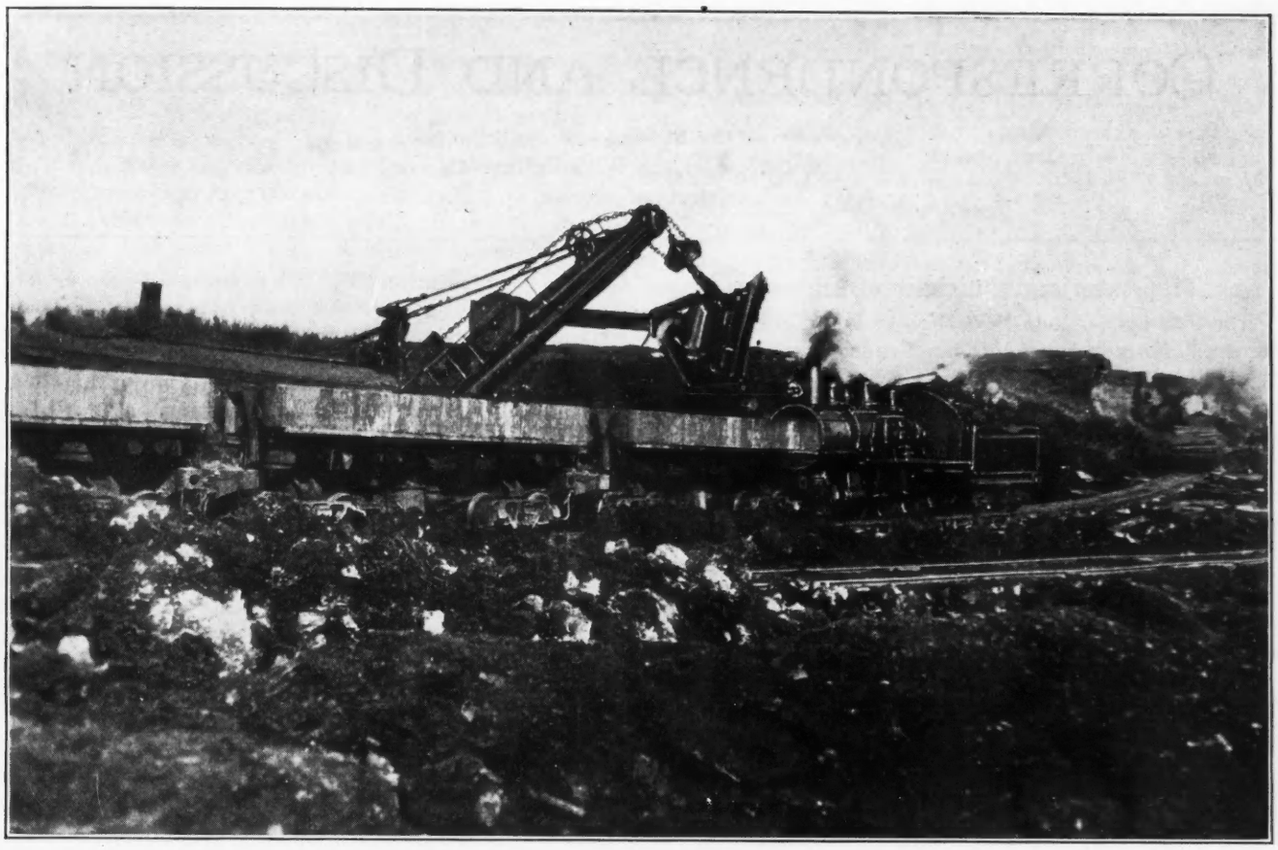
Modern Stripping Equipment in Minnesota



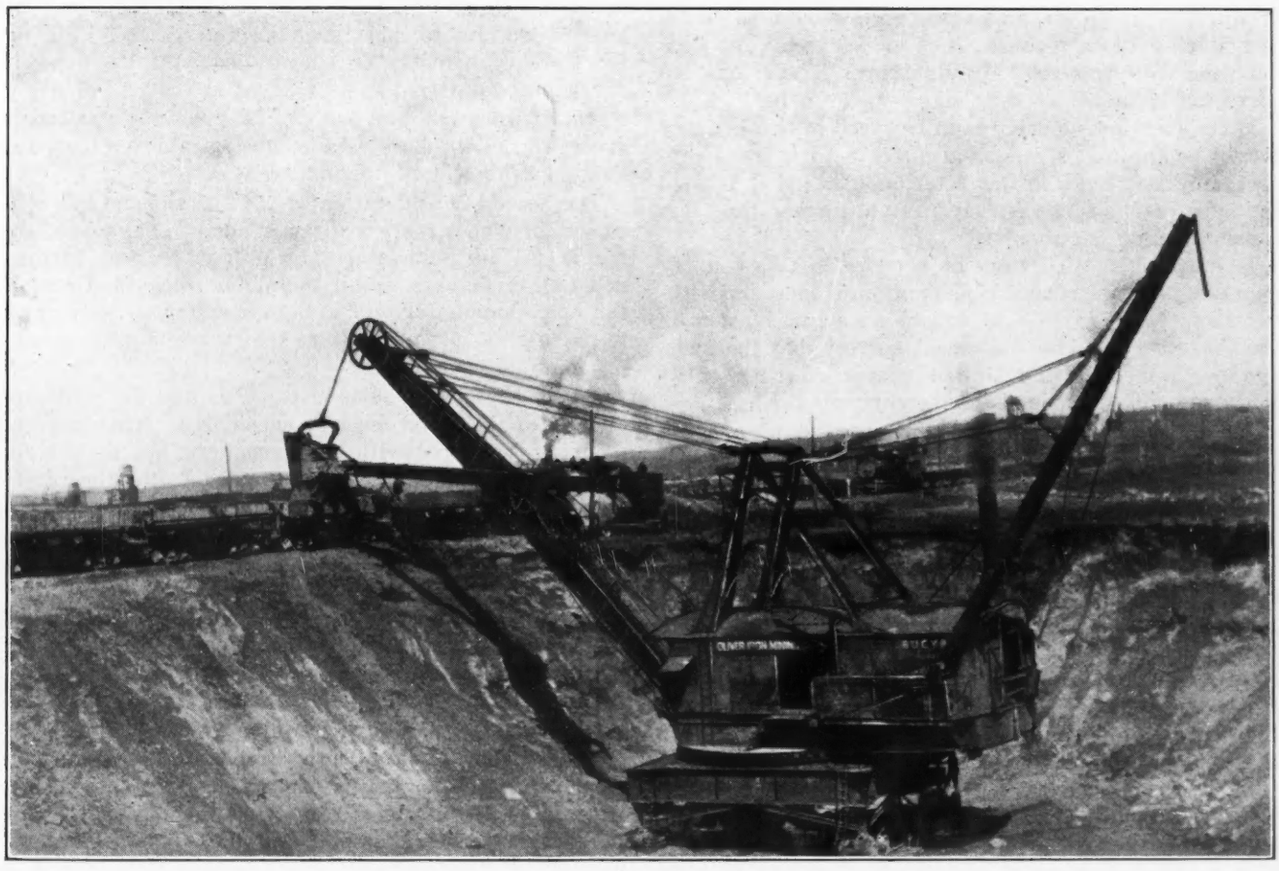
SPREADER BEING USED ON THE STRIPPING DUMP OF A MESABI RANGE OPEN-PIT MINE



MECHANICAL TRACK SHIFTER USED IN MOVING TRACK S ON STRIPPING DUMPS



STEAM SHOVEL LOADING OVERBURDEN INTO 20-YD. ALI-STEEL AIR-DUMP CARS



ONE OF THE 360-TON STEAM SHOVELS NOW USED ON THE MESABI IRON RANGE FOR REMOVING OVERBURDEN

CORRESPONDENCE AND DISCUSSION

Letters From the Mining and Metallurgical Industry Dealing With Pertinent Subjects of Interest

The American Quicksilver Industry

The *Journal* published on May 17 an interesting letter from Murray Innes, of San Francisco, and another from Fletcher Hamilton, both relating to the necessity of fostering the mercury industry of the United States.

Mr. Innes' letter commends most highly the report of the U. S. Tariff Commission upon the mercury situation at home and abroad, but severely criticises the conclusions that F. L. Ransome has drawn from his investigations of the subject. Previous to reading Mr. Ransome's conclusions I had read the report of the Tariff Commission and such other data as have recently been published, and was regretfully forced to almost the same conclusion reached by Mr. Ransome. My conclusions were not published, for they too would have read like an "epitaph of the quicksilver industry in the United States."

As one indirectly interested in the mercury industry, and appreciating the status of those who have done their utmost to fulfill the requirements of the Government in an emergency, I preferred to believe that I was mistaken and that at an early date a more hopeful outlook for the mercury industry might develop. My personal feelings are fully expressed in the editorial of April 19 which Mr. Innes was good enough to quote, and, having those feelings, it is evident why one does not wish to believe that Mr. Ransome's conclusions are correct, irrefutable as they may appear to be.

If the mercury industry is to be saved in this country it will be through stronger arguments than those presented by Mr. Innes in the letter quoted, and it is with the hope of eliciting such stronger argument that this communication is submitted.

Is it possible to continue to produce in this country approximately its normal consumption of mercury without a protective tariff that will be an actual burden on the consumer? Is the statement correct that the average ore mined in the United States (during 1918) contained only five pounds of mercury per ton?

Mr. Ransome believes that the prospect of opening any new deposits of mercury are extremely small and that those deposits now capable of producing will yield less and less per ton as time passes. Is this correct, or do those who are familiar with production of mercury have reason to believe the contrary, and, if so, upon what is that belief based?

What hope can the producer of quicksilver give to the consumer that the protection asked for will not continually rise, that it may remain constant or diminish as the industry prospers? There is no doubt that the European supplies are controlled in London and that within certain limits one house controls the price. It must be noted in passing, however, that this condition has maintained for many years. This house could long ago have closed every mercury mine in the United States and then made prices to suit itself, or it could have done so, if I am correct in my understanding of the European situation; but it has not taken such action. The reason may be that it does not possess physical control of the output, but more probably is because it does not consider such a policy good business. If this firm has not monopolized the business in the past, is there good reason to expect that it will do so in the future?

The quicksilver miners, numerically small, to be entirely successful in their contention for adequate protection must have some support, or at least but slight opposition from the consumers, numerically large. If the miner can convince the consumer that free trade means high prices at no distant date, we will have support from a most important section of the community, and the battle will be more than half won.

There are several interests to consider in this discussion. First, and perhaps the most important consideration, is that of the preparedness of the Nation, the League of Nations to the contrary notwithstanding. What should be the policy of the Government in order to avoid the possible consequences of all foreign supplies being suddenly cut off? Should the Government buy and store enough mercury in times of peace to carry it through two or three years of intensive military preparation? Should it try to conserve all present known deposits to meet such an emergency? Should the mercury industry be encouraged with the hope of developing additional supplies, even at the risk of using up all of which we now know? May we not reasonably expect that, with more detailed geological investigations, new deposits will be found?

The second consideration is that of the normal consumer, of whom there are thousands. What procedure will be to his best interest? Will it be best to take down all tariff bars, admit the metal freely, and cut off the home supply, or will it be better for the consumer to pay a high tax and be sure that there is a home supply to be depended upon?

Third, those who have invested capital for the production of the metal must be considered. They are not many, as compared with the consumers, but their work and expenditures have been in good faith, they have helped win our war, and should not now be left to shift for themselves. There can be but one answer to this question, but the form the aid should take is open to discussion. The experience that is gained in the handling of the war-minerals relief will at least acquaint the Government with full information about the cost of mining operations when undertaken on a relatively small scale.

And, fourth, there is the mining industry in general, and the policy to be adopted respecting war minerals in particular. Mercury is one of those metals, and the need for uniform policy respecting them is plainly apparent. Whatever that policy may be, it will effect the mining industry of the country to a marked degree.

New York, June 16, 1919. F. F. SHARPLESS.

Trouble With Rock-Breaker Pitmans

Even if true, I think the troubles with rock-breaker pitmans described in the Mar. 29 issue of the *Journal*, are a little exaggerated so far as small and medium-sized plants are concerned. It is not advisable to have the pitman water cooled. To do so would require some kind of water jacket, and this would make the pitman more cumbersome. The jacket would be likely to crack and leak. Two lines of hose would be necessary, one to bring the cool water, the other to take the heated water away, and the hose would of necessity be long, in order to absorb all the stroke vibration, and leaks would surely occur. The change may be desirable where water is scarce, although overflow water can surely be used in some other place in the mill. If the rock breaker is situated, as in most cases, on the top of the mill, the pressure may not be sufficient, but a small rotary pump like that used on machine tools could be geared on the crusher shaft. From the engineering standpoint water cooling can be done easily enough, but few would use the water jacket, and many in a short time would discard it after having given it a trial.

In nearly all the swing-jaw types of crushers the pitman bearing extends the full length of the eccentric—the width of the jaw. This is ample bearing surface, but the babbitt must be of the right kind. I have used "Magnolia" with good success on 10 by 15-in. crushers running 16 to 20 hours daily. All the oil pockets are filled with hairy wool waste, packed tight enough so as to be always in contact with the shaft. Lost motion can no more be permitted in the pitman bearing than in a connecting rod, as it causes pounding, more friction, and, of course, more heat.

The toggle must point down toward the pitman, as, if placed slanting off from the pitman, the strain will be on the bearing caps, and this will cause the studs to break quickly. It will also cause undue heating of the bearings, caps, and shaft. The remedy is to raise the block carrying the toggle seat above the toggle seat of the pitman. It may be necessary to change the toggle to keep the jaws to breaking size. Never let the toggle ends and the toggle seats wear down too far. Both get so out of shape (rock and dust helping) that the tension of the spring must be increased to hold them home.

All dust and grit must be kept out of the lubricating oil and grease. A good way is to cover the bearings with a 5-gal. can or a cyanide can. The crusher depends to a large extent on the filtered oil already used on the engines. Castor machine oil has in many cases helped the running of crusher bearings. It is advisable not to fill the oil box of the pitman with waste alone. A little wool waste will do to absorb and hold oil; then, on the top of the waste, place a piece of felt the shape of the oil box, and hold tight by driving a strip of wood. This will act as an oil filter that can be relied upon. The oil grooves in the bearing must be of a shape that will permit oil circulation. One groove usually is not sufficient.

Reversing the motion on a hot-running pitman will help, but it makes but an insignificant change with most crushers, whereas to the bearing it may make a great change, particularly in connection with worn bearings, because one edge has usually worn so sharp that it scrapes nearly all the lubricant off the shaft. Running in the other direction, it faces the beveled edge of the babbitt. Both sides of the bearing must be beveled to ease off and give the lubricant every chance to follow the shaft.

The crusher must be run at a reasonable speed. Overspeeding increases the capacity, but unless of exceptionally heavy construction, it soon breaks the foundation bolts or loosens up the framework. A bent, grooved, or worn shaft also invites trouble.

When an idle pulley is used on a rock-breaker shaft it must have a renewable bushing and an automatic grease cup of ample size. The diameter of the idle pulley must be ½ to 1 in. smaller than the diameter of the driving pulley. The belt tension is lessened and the friction on the bearings greatly relieved when the belt is shifted on the loose pulley. It is of course highly desirable to avoid the loose pulley wherever possible.

Johnnie, Nev., Apr. 10, 1919. C. LABBE.

A New Factor in Flotation Litigation

To anyone who has followed flotation litigation during recent years it must be rather a surprise to learn that there are some features of the process that have not been brought out in the course of the many hearings before the various courts. That some points still remain open for elucidation and discussion is evident, as the *Mining and Scientific Press* of Mar. 22 comments editorially concerning J. D. Wolf's patent.

Apparently this patent, No. 787,814, dated Apr. 18, 1905, the application for which is dated May 22, 1903, is likely to be of importance. As neither of the litigants made a particular point of it in the Hyde case, it seems to have received no consideration from the profession in general. In the action of Mineral Separation, Ltd., *vs.* Butte & Superior the patent apparently is accorded technical attention for the first time. The defendant's expert, Dr. Sadtler, after detailing the working of the apparatus as described by Wolf, concluded his testimony as follows:

"Now, I feel satisfied that we cannot practice this procedure of first practicing agitation with that form of apparatus without producing an aërated froth which holds the mineral, as stated, quite completely, and then, if we follow that by a flotation as described here in these claims, of the mineral-bearing oil, an air-bubble mixture over the top of the spitzkasten, that it is impossible to have anything else than the removal of the mineral-bearing froth."

I suppose it is unwise for one to make predictions or to commit himself as to what bearing certain patents or applications have upon the legal aspect of flotation. Apparently, however, this Wolf patent must be of some importance. It seems that an actual recovery by an oil froth can be made by carrying out the directions of the patent. Coupling this with the fact that Wolf's patent appears to antedate the patents under litigation, it is evident that flotation operators are confronted by a new source of what may be trouble or salvation.

It is unfortunate that this patent has been kept dark for so long, if the facts are as they seem to be. The more light we can get on this situation, the better it will be for every one having any interest in flotation metallurgy. There is an opportunity here for investigators to give attention to the Wolf patent and discuss it in the technical press, just as the other patents and processes have been discussed. H. A. MEGRAW.

New York, May 29, 1919.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Zinc Tariff Gets Hearing

Paul A. Ewart, representing the zinc-mining industry of the Joplin district, appeared before the Committee on Ways and Means in support of the bill providing a tariff of 2c. per lb. on the metallic contents of zinc ore. He stated, however, that all that the producers want is a tariff that will equal the difference between costs here and in Mexico. Though the principal competition is expected from Mexico, Mr. Ewart told the committee that he fears the dumping of German zinc.

Otto Ruhl, representing the Webb City Chamber of Commerce, the Joplin Chamber of Commerce, and the Webb City Mine Sanitary and Safety Association, engaged in the following colloquy during his appearance before the committee:

Mr. Kitchin: Is there any evidence that the zinc producers have, of a combination among the smelters to fix the price?

Mr. Ruhl: There has been such an accusation, but we have not the evidence on that particular question here.

Mr. Kitchin: The general opinion among you zinc producers is that they fix the price among themselves?

Mr. Ruhl: There is some sort of an opinion like that expressed among a certain element of our men.

Mr. Kitchin: What do you think about it?

Mr. Ruhl: I am open-minded, and I am willing to be convinced; but I do not think we have the evidence to do so yet.

Mr. Kitchin: You do not want to cast any reflections because they are your only purchasers and you do not want to embarrass yourself with your purchasers?

Mr. Ruhl: If we find there is such a combination we have legal relief, and I understand we will probably exercise that legal relief if we can do so.

The Chairman: You do not know now that there is any combination?

Mr. Ruhl: No, we do not know it.

Farmers Object to Potash Bill

Farmers and importers are vigorously opposing the proposals to establish a potash-licensing system, or to place a tariff on imported salts. Ben C. Marsh, secretary of the Farmers' National Council, told the Ways and Means Committee that the principle of the Fordney bill is vicious and that the farmers of the country want the bill killed. It is estimated that one-third of the agricultural products of the United States require potash, and that the yield next year will be 30 per cent less if potash is not available at a price the farmers will pay. The decrease in production will be increasingly greater as the reserve of potash in the soil is exhausted, it was stated. Representatives of the agricultural interests of the country were unanimous in their belief that there is no important reason why the United States should tax itself heavily to create a domestic potash industry.

It is inconceivable, one witness pointed out, that this country would be at war with France and Germany at the same time. H. A. Huston, secretary of the German Kali Works, an American corporation, a subsidiary of the potash syndicate of Germany, said among other things:

The American producers are rather sharply divided into two classes. One of these cannot produce potash at a price that the consumer will ever consent to pay; the other class can produce at a price that can compete with any foreign source. One is beyond help, the other does not need it to make reasonable profits on honest capitalization.

A sound national policy would seem to require that those sources from which potash can be produced only at a high cost should be held in reserve as an insurance against another period of shortage, as are the oil-bearing shales. It is not a sound national policy to pay a premium to exhaust these resources and at the same time increase the cost of producing food and clothing.

Federal Aid for Mining Schools

Senator Smoot has introduced a bill providing for the application of part of the proceeds of the sales of public lands to the endowment of schools or departments of mines and mining in each state. The amount to be expended is to be $25,000 per year in each state. The purposes for which the money is to be spent are given in the bill as follows:

Instructions, research, and experiment (including the employment of instructors and experts, the purchasing of apparatus, supplies, books, and the equipping of laboratories) in mining, mining machinery (with the application of electricity thereto), mining engineering, ore-treatment, metallurgy, assaying, and chemistry and geology, so far as these sciences relate to minerals and mining, with a view to teaching a practical and scientific knowledge of the best and safest methods of mining and carrying on the business of mining and of producing gold, silver, coal, and other minerals, oils, gas, and medicinal waters, and also the concentrating, smelting, refining, and other preparation of the same for marketing so far as the same may be necessary and appropriate to the mineral resources of the state or territory in which said school or department of instruction in mines and mining shall be located; and especially for the study and prevention of explosions, fires, and other dangers incident to the carrying on of mining and the mining industry, in order to secure the most intelligent conservation, use, and development of the mining and mineral resources of the country, to make the lives of miners more safe, property in mines more secure, and to promote the general welfare of miners and operators of mines.

Shippers Get Respite as to Bills of Lading

In the long-pending matter of bills of lading, the Interstate Commerce Commission, on June 26, extended by one month the date on which the printed forms of bills of lading now in use should be discontinued. The date is thus advanced from Aug. 8, as set in the order of Apr. 14, 1919, to Sept. 8, 1919. Otherwise the original order remains in full force. This action was taken because it was realized that shippers having printed stocks of such bills on hand would suffer some loss if forced to waste them unused; also the date originally set allowed insufficient time to have new bills printed.

N. Y. Section American Institute of Mining and Metallurgical Engineers

Meeting Addressed by Horace V. Winchell, Who Reviewed Conditions on the Mesabi Range and Recent Advances in Ore Concentration

THE regular meeting of New York Section of the American Institute of Mining and Metallurgical Engineers was held on June 26, 1919, at the Machinery Club, New York City. The usual dinner, followed by the program and entertainment, was attended by seventy-five members and guests. William Young Westervelt was chairman of the evening. Announcement was made of the meeting of the Institute in Chicago, Sept. 22 to 26, 1919, and members were urged to attend. An appeal was also made to the members of the Institute to make every effort to give employment to returning soldiers, not only from patriotic motives, but also for the reason that such men have acquired discipline and a high sense of duty and are usually worth more to employers than men without the Army training.

The president of the Institute, Horace V. Winchell, submitted a resolution expressive of the high esteem in which J. E. Johnson, Jr., who died recently, was held by the members of the Institute. The resolution was adopted unanimously. Mr. Winchell then addressed the meeting, and pointed out the momentous possibilities of peace, and the place that mining and metallurgical engineers would occupy during the impending industrial development. He commented particularly on the iron-ore resources of the Mesabi Range, the annual production of which is 40,400,000 long tons, and reviewed in detail the possibilities of a new mining and metallurgical enterprise which has been brought through the experimental stages to a commercial possibility by Walter G. Swart and Dwight E. Woodbridge.

These metallurgists have devised a method for the treatment of certain extensive deposits of taconite containing 25 to 35 per cent iron in the form of magnetite which promises to be of great commercial importance. The process is the outgrowth of tests conducted by W. G. Swart in an experimental mill built in Duluth in 1916. The ore is crushed to ½-in. size and passed to magnetic cobbing machines, which eliminate 50 per cent of the material, the remainder being delivered to a closed-circuit ball mill. A Davis magnetic log washer receives the ball-mill product and recovers a clean, fine concentrate, representing 30 to 40 per cent of the original ore. The ratio of concentration is approximately three to one. The concentrate is mixed with pulverized fuel, filtered, and sintered on Dwight-Lloyd sintering machines. The sinter is of bessemer grade, and contains 61.18 per cent iron, 0.025 per cent phosphorus, and 11.72 per cent silica.

Mr. Winchell called attention to the great production of the Mesabi Range, which now amounts to 500,000,000 tons of its best ore. He stated that fifteen years ago, about two-thirds of the ore mined was bessemer grade, and contained approximately 0.038 per cent phosphorus, whereas last year only about one-third of the tonnage was bessemer grade, and the phosphorus had risen to 0.045 per cent. At the current rate of production, the supply of commercial ore under present practices will be exhausted in about thirty years, and if the production should increase 10 per cent a year, the exhaustion of the Minnesota deposits might take place in twenty years. The new methods described promised to make large deposits of lower-grade ore available, thereby greatly extending the life of the district, as well as the supply of useful material.

Major C. E. Stuart addressed the meeting on the subject of recruiting for the U. S. Army and pointed out the advantages of the Army as a training school for men who would subsequently go into industry. He called attention to the radical changes in Army life during the last few years, and the new recruiting slogan: "The Army is a builder of men." Major Stuart explained the effect of the educational advantages now offered by the Army, and the wholesale development of "can-do" men under the new system. He stated that the $30 per month to the soldier is equivalent to $125 per month in civil life, and that a young man earning $125 or less per month would do better in the Army, because he would receive a liberal education, which he could not otherwise afford. Major Stuart convinced the members present of the value of the idea.

Major Arthur S. Dwight was received with genuine enthusiasm. In a direct and simple way he told the members of his war experiences, concluding his interesting narrative by the presentation of moving pictures of war-zone activities.

June Mining Dividends

Dividend payments by mining companies in June, 1919, show a big decrease from the amount for the same month last year, owing to continued additions to the list of those companies which have passed their dividends, and those which have decreased their payments. Companies which failed to pay the dividends which would have been due at this time were the following: International Nickel (common), Ahmeek, Allouez, Isle Royale, and Osceola. Calumet & Arizona reduced its payment from $1 to 50c. per share; Copper Range, from $1 to 50c.; Federal Mining & Smelting, from $1.75 to $1; and St. Joseph Lead, from 35c. to 25c. per share.

U. S. Mining and Metallurgical Companies	Situation	Per Share	Total
Am. Sm. and Ref., com	U. S.-Mex.	$1.00	$609,980
Am. Sm. and Ref., pfd	U. S.-Mex.	1.75	875,000
Argonaut, g	Calif.	.05	10,000
Bingham Mines	Utah	.25	37,500
Caledonia, l. s	Ida.	.01	26,050
Calumet & Ariz., c	Ariz.	.50	321,260
Chino, c	N. M.	.75	652,485
Copper Range, c	Mich.	.50	197,500
Cresson Cons., g	Col.	.10	122,000
Fairview Round Mountain, g	Cal.	.02	19,048
Federal Min. & Sm., pfd	U. S.	1.00	120,000
Golden Cycle, g	Col.	.03	45,000
Hecla, l.s	Ida.	.15	150,000
Homestake, g	S. D.	.50	125,580
Kennecott, c	.....	.50	1,393,530
Nevada Con., c	Nev.	.37½	749,797
North Star, g.s	Nev.	.40	100,000
Oroville Dredg., g	Cal.	.12	82,385
Quincy, c	Mich.	1.00	110,000
Ray Con., c	Ariz.	.50	788,589
St. Joseph Lead	Mo.	.25	352,367
Tintic Standard, l.c	Utah	.08	93,400
United Eastern, g	Ariz.	.07	95,410
United Verde, c	Ariz.	1.50	450,000
Utah Copper	Utah	1.50	2,436,735

Canadian and South American Companies	Situation	Per Share	Total
Cerro de Pasco, c	So. Am.	$1.00	$898,224
Hedley, g	B. C.	.10	24,000
Hollinger, s.g	Ont.	.05	246,000
Mexico Mines of El Oro, g	Mex.	.96	174,960
Kerr Lake, s	Ont.	.25	150,000
Min. Corpn. of Can., s	Ont.	.12½	200,006

Whereas, in June, 1918, 40 United States mining and metallurgical companies, making public returns, paid dividends amounting to $24,662,838, only 24 companies are on the list for June of this year, their

payments having amounted to $9,963,616, a decrease of more than 55 per cent.

Canadian, Mexican, and South American companies also show a decrease in their payments, the amount in June, 1919, being $1,693,190, compared with $2,653,442 in 1918.

By error, Hollinger Gold Mines was included in the dividend table of May payments, published in the *Journal* of June 7. The date of its payment was June, and it appears in the present list.

The only holding company to pay in June, 1919, was the Yukon Alaska Trust, which made its usual quarterly payment of $1 per share.

The totals for the first six months are as follows, the figures for the corresponding period of last year being given in parentheses: United States mining and metallurgical companies, $50,039,792 ($89,763,010); holding companies, $900,005 ($1,066,866); Canadian, Mexican, Central and South American companies, $8,060,281 ($9,719,686).

Lake Superior Metal Mine Safety Conference at Duluth

Meeting of Representatives From Every Mining Range in the Upper Peninsula of Michigan and Wisconsin and Minnesota

THE Lake Superior Metal Mine Safety Conference was held at Duluth on June 19-20. Among the many papers, the following were presented: "Proper Safety Organization for Metal Mining Companies," by George Martinson; "Common Open-Pit Accidents and Their Prevention," by H. E. Mitchell; "Americanization of Mine Employees," by George H. Crosby; "The Safety Engineer and Accident Statistics," by A. H. Fay; "Open Stopes," delivered for M. E. Richards by J. J. Griffiths; "Underground Disaster Warnings," by B. O. Pickard; "Some of the Different Methods of Interesting Our Mine Employees in Accident Prevention," by B. D. Shove; "The Problem in the Work of Accident Prevention," by William Conibear; "Work of the Safety Division of the Bureau of Mines," by D. J. Parker, and an address on general safety problems by F. E. Morris.

The committees in charge were as follows: Program, George Martinson, William Conibear, and Stephen Quayle; meeting plans and hotel accommodations, A. A. Krogdahl and George Lohneis; reception and luncheon committee, A. A. Krogdahl, George Lohneis, B. D. Shove, and E. A. Sporley.

After the luncheon on June 20, C. E. Julihn spoke on "Neighborliness as an Industrial Factor."

A resolution was unanimously passed recommending that the U. S. Bureau of Mines should consider making these conferences annual affairs in the district, as it was felt that such conferences should be prompted by the Bureau of Mines rather than by an organization of safety engineers in the district.

The testimony taken by the Committee on Ways and Means of the House of Representatives on potash, magnesite, and tungsten will be of interest to a large proportion of those engaged in mining. A copy of any one of these hearings may be obtained gratis on application to Paul Wooton, 307 Union Trust Building, Washington, D. C., the *Journal's* special correspondent.

BY THE WAY

Emerald and Molybdenite

Molybdenite has a greenish streak at times, according to Dana. In this connection it is interesting to note that William J. Spain, of New York, who operates the Spain molybdenite mine at Dacre, Ontario, is also the local treasurer for Ireland's victory campaign fund. "The Irish have declared a republic," run the advertisement in New York street cars soliciting contributions for the fund. More evidence of the versatility of mining men.

Unpatented

"H. W. Hardinge has spent two weeks at his camp in Spencer, Me.," writes a friend. "Fishing was very good, and Mr. Hardinge caught one that was too large to be weighed on any scale in Maine. However, being of an inventive turn of mind, he hung the fish on a tree and weighed it on its own scales. Furthermore, the camp being eighteen miles from the nearest town and difficult to find, he hung the small fish on trees to act as guides, the scales showing the weigh."

Thus we see that one can be comical as well as conical.

Joking at a Funeral

War-mineral producers who suffered loss in their effort to aid the Government have our deep sympathy. To this is added our admiration in the case of the manganese operator in Tennessee, who jestingly announced his loss to the War-Minerals Relief Commission as follows:

> The sudden death of the manganese market upon the signing of the armistice, having plunged the —— —— Manganese Co. into deepest mourning to the extent of about four thousand dollars, Mr. Wilbur A. Nelson, State Geologist of Tennessee, directs that we take this matter up with you, as being the one best qualified to offer consolation in our bereavement. If you will kindly suggest how we may best shape our supplications for relief from our distress we will consider ourselves under many obligations to you.

To this H. E. Meyer, chief clerk of the commission, replied in like vein:

> I am in receipt of your letter of Apr. 17 and am very sorry to learn that the —— —— Manganese Co. has, by the unexpected death of the manganese market, been required to take on the garb of mourning. I very fully appreciate your need for sympathy in your great bereavement. Having learned in advance from Dr. Wilbur A. Nelson of your loss, I took it upon myself to forward to you under date of Apr. 18 the regulations and questionnaire prepared by the War-Minerals Relief Commission, with the suggestion that you prepare your claim for relief from your dire distress.
>
> The regulations and questionnaire are very simple and I am sure you will have no difficulty in shaping your supplications for relief. I will say that the questionnaire must be sworn to before a notary public or clerk of a court of record. June 2 is the date for the placing of claims with the commission for final rest; so therefore get busy with your undertaker, and have your claim properly embalmed and shipped for burial. Having so disposed of your claim this at least should give you some relief, pending the commission's autopsy of your case.

If the commission, now conducting hearings in Western cities, finds other producers as amiable, its task will at least be pleasant.

PERSONALS

C. F. Kelley is going to Butte in connection with the labor situation there.

H. G. Officer sailed for Chile on June 21, where his address will be Casilla 83-D, Santiago.

J. W. Russell, of Woodstock College, Woodstock, Ontario, has resigned his position to become manager of the Oxford Cobalt silver mine.

August Heckscher, president of the New Jersey Zinc Co., has been elected a director of the Crucible Steel Co. of America.

T. O. McGrath, auditor, Shattuck-Arizona Copper Co., appeared before the War-Minerals Relief Commission, at its recent sitting in Tucson.

Arthur W. Jenks is in New York on his return from Namtu, Burma, where he was smeltery manager for the Burma Corporation.

F. M. Van Tuyl, who has recently joined the staff of the Malm-Wolf Co. as consulting geologist, is examining oil properties in Wyoming, where he expects to be engaged until Aug. 1.

E. F. Simms, vice-president of the Sinclair Gulf Corporation, will be president of the Simms Petroleum Co., with extensive acreages in the Texas oil fields.

Fred Carroll has discontinued his duties as State Commissioner of Mines in Colorado, and resumed his former position as general manager of the Atlas Mining Co. near Ouray.

Horace F. Lunt has been appointed State Commissioner of Mines of Colorado, succeeding Fred Carroll. Mr. Lunt served during the war as a captain in the U. S. Army.

A. Tancig, mechanical superintendent of the mining operations of the Shenango Furnace Co., has returned from a business mission in Buffalo, N. Y.

Richard Hamilton has been re-elected president of the Western Australian Chamber of Mines. Mr. Hamilton has been president for twenty-two consecutive years.

James Flannigan, superintendent, Higgins mine, has returned to his home in Bisbee, after making a tour of examination of the oil fields of central Texas.

G. Chesterfield Evans, a member of the metallurgical staff of the Oriental Consolidated Mining Co., Unsan, Korea, has left Australia, where he has been spending his vacation, to return to Korea.

W. H. MacMahon, formerly safety inspector of the Northern Ore Mines District of the Republic Iron & Steel Co., has accepted a position as employment manager for the American Hoist & Derrick Co., of St. Paul, Minn.

F. D. Adams, dean of the Faculty of Applied Science, McGill University, Montreal, who went abroad last year as deputy director of educational services of the Canadian military forces, has returned to Montreal.

Richard Tarantous, who first served in the Engineers Corps on the border and later with the tank service in the battle in the Argonne, was recently discharged from the service. His address is 1,050 Clay Ave., New York.

H. S. Mulliken, for some years engaged in active metallurgical work in Mexico, with the A. S. & R. Co., and afterward with the Peñoles Mining Co., and Cia. de Minerales y Metales, will have his headquarters in the States after Sept. 1, continuing to act as consulting metallurgist for the last two named companies, in addition to other professional work.

Herbert C. Hoover, in addition to many other honors awarded him during his tenure of office as Food Director of the United States, and subsequently as Director General of Allied Relief, was included in the honor roll of Oxford University, receiving the degree of Doctor of Civil Law at the exercises held on June 25. Only one other American, General John J. Pershing, was so honored. Many of the war's greatest diplomatic, economic and military leaders also received the degree, the list including the Prince of Wales, Marshal Joffre, Marshal Haig, Admiral Beatty, Premier Orlando of Italy, and Premier Venizelos of Greece. Mr. Hoover has resigned as chairman of the Food Administration Grain Corporation, but remains as a director.

HERBERT C. HOOVER

Arthur W. Burgren has been appointed superintendent of the Dolores Mines of the A. S. & R. Co., at Matehuala, San Luis Potosi, Mexico.

Rex R. Seeber, formerly manager of the Winona Copper mine, in Michigan, is now situated at Dalhousie, New Brunswick, where he is in charge of extensive lumber interests.

E. N. Patty, assistant to Milnor Roberts, dean of the college of mines, University of Washington, started on June 22 on a trip through various parts of the State of Washington.

J. Leonard Replogle, chairman of the board of the Wharton Steel Co., Wharton, N. J., has been elected a director of the Sinclair Oil & Refining Corporation.

R. A. McGovern, general manager of the Caloric Co., a subsidiary of the Mexican Petroleum Co., has arrived in New York from Rio de Janeiro, Brazil. Mr. McGovern expects to leave on a tour of Europe about September.

Charles F. Willis, consulting supervisor, Department Industrial Relations, Phelps Dodge Corporation, has returned to his home in Warren, Ariz., after making a tour of the copper mining camps of the state.

G. W. Grey, superintendent of mines, for the Rio Tinto Co., Ltd., with headquarters at Rio Tinto, Huelva, Spain, is making a tour of the various mining camps in Arizona, including Bisbee, Ajo, Globe, Miami, Clifton, Morenci, and Jerome, studying modern mining methods employed in the various operations of the state.

Amasa Stone Mather, head of Pickands-Mather & Co., with a party of associates, made an inspection tour of the company's Mesabi Range holdings June 25-26. In the party were **Henry Coulby** and **William H. McLoughlin,** of Pickands-Mather & Co.; **George Downs,** of the Lackawanna Steel Co., and **C. H. Munger, W. P. Chinn,** and **W. A. Rose,** of Duluth, local officials of Pickands-Mather & Co.

OBITUARY

William G. Sharp, president of the United States Smelting, Refining and Mining Co., since its organization, in 1906, died suddenly on July 1, at his home in Wenham, Mass. He was born in Utah and was graduated from Rensselaer Polytechnic Institute in 1879.

William Thum, superintendent of the United States Metals Refining Co.'s East Chicago plant, died at his home in Hammond, Ind., on June 28. Mr. Thum was specially interested in the electro-metallurgical treatment of copper, nickel, silver, lead, bismuth, and zinc. A more extended notice of his career will be published in the *Journal* in the near future.

SOCIETIES

The Engineers' Club of Northern Minnesota on June 21 entertained 200 members of the American Society of Civil Engineers, adjourned from the regular annual convention at Minneapolis. The guests arrived on a special train and were taken through the Hull-Rust-Mahoning mines, at Hibbing, and later by automobile across the range from Hibbing to Eveleth.

American Mining Congress, Arizona Chapter, held the bi-monthly meeting of the directors on June 27 and 28, in San Francisco. The following at-

tended: Robert E. Tally, assistant manager, United Verde Copper Co., Jerome; B. Britton Gottsberger, ex-general manager, Miami Copper Co., Miami; W. B. Gohring, superintendent of mines, Calumet & Arizona Mining Co., Bisbee; George Kingdon, general manager, United Verde Extension Mining Co., Jerome; Norman Carmichael, general manager, Arizona Copper Co., Clifton; L. S. Cates, general manager, Ray Consolidated Copper Co., Ray; J. A. Burgess, general manager, United Eastern Mining Co., Oatman; J. Kruttschnitt, Jr., manager, A. S. & R. Co., Tucson; W. C. Browning, general manager, Magma Copper Co., Superior; W. G. McBride, general manager, Old Dominion Co., Globe; Captain Joseph P. Hodgson, manager, Morenci branch, Phelps Dodge Corporation, Morenci; G. H. Dowell, general manager, Copper Queen Branch, P. D. C., at Bisbee.

INDUSTRIAL NEWS

Walter A. Zelnicker Supply Co., of St. Louis, has added 2,000 sq.ft. to its present office space at 325 Locust St., St. Louis, Mo.

The Celite Products Co., New York, announces the appointment of Edward F. Davis as sales engineer in northern New Jersey on the application of Sil-o-Cel insulation and Filter-Cel for filtration.

Stephens - Adamson Manufacturing Co., Aurora Ill., has announced its new representation in the San Francisco district. The firm of Bannon, Bodinson, MacIntyre, Inc., 317 Market St., San Francisco, will have charge of the engineering sales work in this territory.

Cavein Rock Fluorspar Co., Evansville, Ind., filed articles of incorporation for the mining, treating and selling fluorspar for use in the tempering of steel, with a capital of $60,000. Directors are William E. Barnes, William P. Walsh, and P. F. Persons.

H. D. Staley and **G. A. Fisher,** doing business under the name of Western Steel & Engineering Co., 35 Montgomery St., San Francisco, have been appointed California representatives for the United Filters Corporation. They are also representing "Beaver" brand drill steel and "Duroloid" grinding balls.

Leeds & Northrup Co., Philadelphia, Pa., has opened a pyrometer sales and service department at 1304 Monadnock Block, Chicago. A complete standardization equipment will be maintained, and certification of thermocouples and of pyrometer equipments will be furnished in terms of standards certified by the United States Bureau of Standards. Particular attention will be given to maintaining equipment after installation. The office will be in charge of Henry Brewer.

D. Tyne O'Day & Sons, Rio de Janeiro, Brazil, announces the opening of offices at 149 Broadway, New York, to carry on a business in Brazilian products as follows: Manganese ore, ferromanganese, pyrolusite, zirconium, monozite, and similar materials. The company, having its own salesmen and buyers throughout Brazil, is prepared to market American manufactured products. The New York office is under the management of Herbert S. Davis.

Hendrie & Bolthoff Manufacturing and Supply Co., Denver, Col., have been recently appointed exclusive distributors in the Rocky Mountain region for the Shelby cold-drawn seamless steel tubing made by the National Tube Co. The wide range of uses for which it is peculiarly adapted includes heater, condenser and evaporator tubes, bushings, washers, axles, automobile parts, ball-bearing sleeves, boring bars and an extended list of manufactured articles. The June stock list of sizes on hand in Denver is available for distribution. This list also gives information on outside diameters, thickness of material, decimal equivalents, weight per foot and list price per foot.

TRADE CATALOGS

"Pedigreed Gears." R. D. Nuttall Co., Tractor Department, 2,133 Conway Building, Chicago. Catalog, 6 x 8¾; 16 pp.; illustrated. Descriptive of the Nuttall tractor gears, which are designed to meet the severe service required in tractor work. A discussion is included on gear troubles and inefficiency resulting in escape of power in transmission, as well as effect of uneven wear of bearings and vibration. It is claimed that with cut heat-treated gears and anti-friction bearings, the power loss is reduced to 3 per cent for each gear set, which amounts to 9 per cent for three sets, as compared to a loss of 10 per cent per set for rough-toothed gears.

Nordstrom Lubricated Plug Valve. The Merrill Co., formerly Merrill Metallurgical Co., San Fraicisco, Cal.; catalog, 6½ x 10; 22 pp.; illustrated. Descriptive of the Nordstrom valve, particularly designed for the handling of cyanide solutions and slimes. It has been in use in mining camps of Mexico for over three years, particularly in Pachuca and El Oro. The basic principle is the combination in a plug valve of lubricant conduits and a lubricant chamber at the base of the plug so positioned that when pressure is applied to the lubrication screw this pressure operates to lift the plug from its seat and simultaneously to distribute lubricant over the bearing surfaces. It possesses a full 100 per cent opening in the plug.

Austin Rock Crushing Equipment. Austin Manufacturing Co., general offices, 910 South Michigan Ave., Chicago. Catalog 28; 9 x 12; 48 pp.; illustrated. Describes the company's gyratory crusher, which has an automatic oiling system, rigid eccentric bearing, countershaft supported on each side of driving pinion, retains full eccentric bearing surface when head is raised, and is thoroughly protected from dust and grit. The portable crusher is also described. The Austin standard screens with dust jackets and the municipal revolving type; elevators of the pipe frame or municipal, belt and traction chain types; bins, of the portable telescope and stationary types, and dump cars are described. Detailed drawings of complete Austin crushing plants installed at various properties are also included, as well as a number of tables of engineering data.

NEW PATENTS

U. S. patent specifications may be obtained from the *Engineering and Mining Journal* at 25c each.

Drill Sharpener. Jesse Ditson, Littleton, Col., assignor to the J. George Leyner Engineering Works Co., Littleton, Col. (U. S. No. 1,304,459; May 20, 1919.)

Electrodes—Production of Electrodes. William Kingman Page, Chicago, Ill., assignor to Chile Exploration Co., New York, N. Y. (U. S. No. 1,302,959; May 6, 1919.)

Electrolysis, Process of. Herbert I. Allen, Portland, Me., assignor to Electron Chemical Co., Portland, Me. (U. S. No. 1,303,226; May 13, 1919.)

Electrolytic Slimes, Treatment of. William C. Ferguson, Garden City, N. Y., assignor to Nichols Copper Co., New York, N. Y. (U. S. Nos. 1,305,787, 1,305,788; June 3, 1919.)

Filtering Apparatus. Michael H. Kuryla, San Francisco, Cal., assignor to Merrill Metallurgical Co., San Francisco, Cal. (U. S. No. 1,302,812; May 6, 1919.)

Furnaces—Construction of Roof of Openhearth and Reverberatory Furnaces. George Campbell Carson, San Francisco, Cal. (U. S. No. 1,302,307; Apr. 29, 1919.)

Hoisting—Safety Device for Mines. James A. Nolan, Bowerston, Ohio, assignor to the Mining Safety Device Co., Bowerston, Ohio. (U. S. No. 1,301,732; Apr. 22, 1919.)

Filtering—Process of Maintaining Filters in Filtering Condition. Michael H. Kuryla, San Francisco, Cal., assignor to Merrill Metallurgical Co., San Francisco, Cal. (U. S. No. 1,302,813; May 6, 1919.)

Drills—Cylinder and Guide Construction for Hammer Drills. Lewis C. Bayles and Fred M. Slater, Easton, Pa., assignors to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,304,442; May 20, 1919.)

Flotation—Differential Flotation Concentration of Sulphide Ores and Raw-Ore Products. Charles Cuthbert Freeman, Broken Hill, New South Wales. Australia. (U. S. No. 1,301,551; Apr. 22, 1919.)

EDITORIAL CORRESPONDENCE

Current Events and Topics in Brief of Interest to Engineers and Operators

SAN FRANCISCO, CAL.—June 26

Potash Production from the Mohave desert will have a decided impetus if all those who have received permits from the Government start operations. Ten permits have been issued for Searle's Lake, four for Mesquite Valley, and five for ...yo County.

Strikers at Grass Valley Mines were joined on June 21 by the engineers and pump men, who walked out after the expiration of their 24-hour notice to the operators. C. A. Brockington, superintendent of the Allison Ranch mine, has made it known that his company will accede to the new schedule for the few men he employs, but only in the departments affected by the strike. The rest of the force are employed under the contract and tributing system. Deputy State Labor Commissioner John D. Blair arrived on June 21, with instructions to use every possible means to effect a settlement. A proposal by the operators to abolish the bonus system, establish a free market, and grant a percentage wage increase was rejected.

Consolidated Virginia Mining Co., on the Comstock lode, made a record shipment to the Mexican mill in the week ended June 14, amounting to 425 tons, valued at $11,223. Ophir shipped 223 tons, valued at $5,013. The average of the Consolidated Virginia ore was $26.43 per ton; Ophir, $22.48. In the week ended June 21 the total ore shipped and crushed was 492 tons, of a total value of $13,336. Consolidated Virginia shipped 269 tons, averaging $29.44 per ton, and Ophir 223 tons, averaging $24.29. The mill was run 96 per cent of the time in the first week and 81 per cent the second week. Prospecting and exploration in Union, Mexican and Sierra Nevada are progressing favorably, and indications are good for development of commercial ore in sufficient amounts for shipment.

GOLD HILL, ORE.—June 27

War-Minerals Relief Committee will hold hearings at Medford, Ore., about Aug. 5 to receive further evidence supporting claims filed in southern Oregon and northern California. Claims filed are to be for net losses. Operators must show that sufficient ore existed to yield profit had market been able to absorb ore.

Gold-Mining Activity has not been resumed in southwestern Oregon as readily as had been hoped for, owing to the continued scarcity and high cost of labor a supplies. Many mine owners who during the war had sold much old mill and mine equipment at great profit now find it impossible to obtain machinery at any price to replace the old. Little development wo k is in progress. A few copper and mercury deposits are being worked. Chrome a d manganese mining is, of course, wholly suspended. The general revival of the lumber industry and the building of the Pacific Highway and other roads is held responsible for the shortage of mine labor.

The Oregon Bureau of Mines, which suspended all field work and publications during the war, has again resumed its activity, and with the liberal appropriation recently made by the Legislature purposes to extend its investigations. The auto truck engineering crew of the bureau is operating in the Jacksonville district, west of Gold Hill. Equipment consists of an auto truck, upon which is mounted a complete sampling, crushing and assaying outfit, the power machinery of which is operated by the truck motor. This party, consisting of five men, is making detailed examination during this summer of partly developed mines in the region, most of which are now idle. The work of investigating oil and gas possibilities in eastern Oregon is being done jointly with the U S. Geological Survey. The state bureau has secured a firm of consulting oil geologists to conduct investigations in western Oregon. Insufficient work has been done hitherto to obtain the necessary geologic information upon which to prospect for oil and gas.

ABERDEEN, WASH.—June 21

Two Carloads of Casing and one carload of machinery for Standard Oil Co.'s projected well near Moclips, Wash., at the end of the branch line of the Northern Pacific, 30 miles north of Aberdeen, arrived at Moclips the middle of June and are being transported to the site of the oil derrick over wagon roads, construction of which has just been completed. Offices and cook house are finished, as is the laying of mud sills for derrick and engine room, and indications point to an early start of actual drilling.

ROAD BUILDING BY STANDARD OIL CO., NEAR MOCLIPS, WASH. LAST STRETCH IN SEC. 8-20-12, JUNE 5,1919.
Photo by Girard & Frank, Aberdeen, Wash.

Shell Oil Co.'s Geologists arrived at Aberdeen this week. This is taken in some quarters to indicate intention on the part of that corporation to enter the Grays Harbor oil exploration field, but no statements to that effect have been authoritatively made. No activities, in fact, of the number of companies, mostly newly organized, now in the field safely may be taken as affording sound indication of actual development intentions. Nothing has transpired clearly to prove that any exploration of oil prospects is planned other than that undertaken by the Standard Oil Co., upon some stage of whose work, in the opinion of most local observers, other concerns are waiting before starting development prospects themselves.

WALLACE, IDAHO—June 26

Managers of Coeur d'Alene Mines will make no concessions to the International Union of Mine, Mill, and Smelter Workers, successor to the Western Federation of Miners, nor will they do anything that could be construed as a recognition of the organization. This in substance is the answer given to Robert M. McWade, Conciliation Commissioner, representing the Department of Labor, who has been in Wallace for the last two weeks. Mr. McWade invited the managers to meet him in a body and discuss the situation, the result of the conference being as stated. He does not appear to regard the matter as finally settled, however, for in adjourning the conference, he stated that it was necessary for him to leave for a few weeks and that he desired to meet the managers again upon his return.

BUTTE, MONT.—June 26

Options providing for a 60-day examination of the property of the old Bluebird mining company, embracing 21 claims, together with adjoining property, are being sought in Butte, presumably by an outside company. The Bluebird has large bodies of silver-zinc-lead ore, and 20 years ago was a producer of silver ore. A large mill erected on the ground failed in its treatment of the ore in consequence of its high zinc content.

Initial Payment of $110,000 for a tract of ground lying on the west side of the Butte district and known as the Bernard placer and the West Yellow Jacket claim, has just been made in a deal involving a total payment of $330,000. This territory is more than a mile long and from 300 to 400 in width, lying at right angles across the strike of the large fissure system of the Anaconda company, embracing the Syndicate vein on the north and the Stewart on the south, two of the largest producing fissures in the district. Payment was made through Joseph C. Pyle, a prominent mining engineer and geologist, connected with the W. A. Clark interests.

Organization of Montana Mining Association, with headquarters at Helena, during the last week is the first step of Montana owners of mining property to act in concert in bringing the merit of their claims properly before Eastern capital: also to act together in the suppression of wildcat mining flotations. Former State Senator C. S. Muffly, of Broadwater County, was named chairman, with Lieutenant Governor W. W. McDowell vice-chairman, and L. S. Ropes temporary secretary-treasurer. Addresses were made at the organization session by Governor S. V. Stewart and Mr. McDowell. Twenty years ago the state boasted a mining association but it soon fell into the discard. The silver boom is responsible for its revival.

SALT LAKE CITY, UTAH—June 26

The Park City Strike is at an end, and the men are going back to work under the conditions prevailing at the time of its beginning on May 6. Normally there are employed in this camp between 700 and 800 men, and production has been averaging 8,000 to 9,000 tons per month. There are estimated to be 300 to 350 men at work. The number for the Judge Mining & Smelting and Daly West is estimated at 75 to 100; for the Silver King Coalition at 85 to 90; for the Ontario Silver, at 40; for the Silver King Consolidated, at 20. Other properties opening up include the Three Kings, Naildriver, Iowa Copper, and Park-Utah. It will probably take two to three weeks before working forces are built, as these have been scattered to some extent. However, the more permanent and more dependable men have remained, and others are coming from outside as they hear that the mines are opening up.

A Survey of Metal Production in Utah in 1918, according to advance figures by the U. S. Geological Survey, shows Salt Lake County to lead, with 13,742,108 short tons of ore, from which was produced 100,477 fine ounces gold, 3,022,638 fine ounces silver, 213,236,973 lb. copper, 88,681,872 lb. lead, and 11,160,521 lb. recoverable zinc, the total value of which was $65,087,444. Juab County was first in production of silver, second in lead, and second in total value. The figures are: 304,415 short tons treated, 30,408 oz. gold, 4,994,806 oz. silver, 5,896,223 lb. copper, 25,823,858 lb. lead, 218,061 lb. recoverable zinc; total value of output $8,933,104. Summit County, with Park City the center of activity, was third in silver and lead produced, and in value of output. Ore treated amounted to 116,797 tons, from which was produced: Gold, 3487 oz.; silver, 2,061,392 oz.; copper, 544,322 lb.; lead, 16,361,250 lb.; recoverable zinc, 103,849 lb. The total value of these metals was $3,435,033. There were 16 producing counties.

Report of Treatment of Low-Grade Ores by volatilization, by the U. S. Bureau of Mines at the University of Utah,

for work done during May, shows new Cottrell treaters and large rotary kiln just installed to have worked satisfactorily. During the month three ores typical of the Park City district were treated; one a very complex silver-lead-zinc-iron sulphide ore, the content of lead and zinc averaging about 15%; the second type representing oxidized ores of lead practically free of zinc; and the third type partially oxidized lead ore containing a little zinc, representing large tonnages at present on dumps in the district. It was found possible to extract practically all of the lead from each of the samples and the greater part of the silver from the oxidized ores. The complex sulphide ore has not responded to the volatilization treatment as readily as the other ores and had to be pre-roasted to drive out the greater amount of sulphur before it was subjected to the chloridizing roast. As this is typical ore, representing large tonnages, considerable time is being given to the problem. It has been possible to drive off practically all of the lead, but the silver extraction up to the present has not been satisfactory.

Assessed Valuation of Utah Mines under the new state law operating for the first time this year is in round numbers $100,000,000, as compared with $46,000,000 last year. Metalliferous mines are now taxed on a basis of three times their net proceeds and, in addition, according to their improvements—including milling plants, whether situated at the property in question or not, such as the Magna and Arthur plants, of the Utah Copper, formerly separately taxed by the county—instead of at their net proceeds plus an "occupation" tax, as last year. Non-metalliferous mines, represented chiefly by coal mines, are taxed according to a cash valuation fixed by the state board of equalization. As will be remembered, an effort was made by the mining industry in this state to have the law in regard to mine taxation read as "not to exceed" three times the net proceeds. The law in this form was approved by the State Senate and had the sanction of the Governor, but failed to pass the House. Mining companies opposing the "occupation tax" as unconstitutional had withdrawn suit instituted and paid the tax, with the understanding that the law would read at "not to exceed three times the net proceeds." The Governor, on the failure of the House to pass the law in this form, was released from any obligation by the the mining interests.

DENVER, COL.—June 26

An Independent Co-operative Ore-Treatment Plant, to be erected in Denver, is favored by various metal-mine operators of Colorado. No actual plans have yet been made for the erection of such a plant, and it remains to be seen whether anything will come of the proposition. The opinion is expressed that the concern will be backed by small producers if anything comes of it.

The State Mines Development Association was organized some time ago in Denver, with the object of governing the operations of a company (to be formed) that would aid in the development of prospects to the point where they might be termed mines, thus eliminating the promoter and wild-catting. It was planned to organize a board of representative business and mining men in each of the ten mining districts. The association does not seem to have extended its activities to any of the mining districts in Colorado.

CLIFTON, ARIZ.—June 27

Shannon Copper Co.'s Holdings recently purchased by the Arizona Copper Co., Ltd., of Clifton, Ariz., include 17 claims once acquired from the latter company, a well-equipped railway from the mines to the smeltery below Clifton, the smeltery, concentrator, offices, and considerable realty. The furnaces are to be scrapped and the railroad will not be operated, though possibly maintained for future use. The Arizona company has been narrowing the scope of its operations for some time, and has closed down its workings at Metcalf and Coronado, as well as its No. 4 concentrator at Clifton, which has handled the ores from the sections named. The Metcalf district is therefore idle, save for a little work by lessees.

JEROME, ARIZ.—June 27

Steam Shovels at United Verde Mine are working toward the upper "hot stopes" on benches that correspond to the 150 and 300 levels. These shovels are expected to cut down through the entire burnt zone of the mine, removing what has been more of an irritation than a danger. The cost of extraction of this ore will be relatively small. Embraced within the operations will be the bench formerly occupied by the United Verde smeltery, and the company's main offices will have to be removed to a place prepared on the 300-level bench. The company's present operations consist mainly of exploration work on its deepest levels. A coal-crushing plant is also being installed preparatory to doing away with oil firing of reverberatories.

GLOBE, ARIZ.—June 26

Inspiration Consolidated Copper Co. is equal partner with Anaconda Copper Mining Co. in the purchase, for about $1,600,000, of 160 acres of producing oil land in the Bakersfield district of California. Title has been passed to an Arizona corporation formed for the purpose. The purchase was for the purpose of protecting the fuel supply of the two companies, which are closely associated. For months past Inspiration has been securing most of its power from the reverberatories at the International Smeltery, as Roosevelt hydro-electric works, with a low reservoir level, could not be relied upon. It happened that Inspiration had no need of this Roosevelt power, but the default emphasized the need for maintenance of the company's own power plant for possible use in the full operation of the mines and of the 20,000-ton mill.

BISBEE, ARIZ.—June 27

The Southwestern Oil Co., recently formed to explore some of the oil districts of Texas, is attracting considerable notice at this time among the mining fraternity of Arizona, principally because its incorporators and principal stockholders are prominent mining men of the state. Practically all of the stock of the company is held by mining men in various Arizona copper camps. The new manager is H. E. Barkwell, formerly of Bisbee, Ariz., where he had charge of the Phelps Dodge churn-drilling operations on Sacramento Hill. Two deep wells are to be started immediatly by the company on its "Woods tract," which lies several miles northwest of Ranger, Tex., in a district which has recently brought in a heavy producer known as the Perkins well.

TYRONE, N. M.—June 27

The Stopping of Copper Production at the Burro Mountain branch of the Phelps Dodge Corporation at Tyrone, N. M., as recently announced, and the turning of attention to development and repairs indicates the company's policy. Tyrone cannot produce copper at a profit at the present market, with the present cost of labor and supplies, it is officially stated; moreover, there is no incentive to produce copper now. The employment situation in Tyrone is little affected, as practically all miners who have been producing ore for the mill have been placed on development work, which will be pushed. Testing is being done in the big mill, which will probably result in remodeling.

AUSTIN, TEX.—June 28

Two Pipe Lines to carry oil from West Columbia and Ranger to coast will be completed soon. Pipe line of Humble Oil & Refining Co. from West Columbia to Webster tank-farm is nearly finished. Completion of the second line of the Texas Co., from Ranger to Port Arthur, has been interfered with by weather.

The Texas Co. has recently increased its capitalization from $69,275,000 to $85,000,000 by an amendment to its charter filed in Austin on June 18. This increase was authorized at a meeting of the board of directors held in Houston last December, and, it is stated by officials of the company, represents increase in the company's business.

The Railroad Commission has formed a temporary organization and adopted temporary rules and regulations for enforcing the oil and gas conservation law, which became effective June 18. Before permanent rules and regulations are adopted, a general hearing will be held in Austin on July 8. J. L. Milden, of Wichita Falls, has been appointed deputy supervisor. Commissioner Clarence E. Gilmore has left for west Texas oil fields to study conditions.

A Law To Prevent Waste of Oil and Gas has been enacted by the Texas Legislature, becoming effective June 18, 1919. Its enforcement is the duty of the Railroad Commission. The law prohibits waste of natural gas, crude oil, or petroleum, defining waste as: (a) Escape of natural gas in commercial quantities . . . except from gas pockets at high points in strata recognized as oil strata; (b) drowning with water of a gas stratum; (c) underground waste; (d) wasteful utilization of such gas; (b) burning flambeau lights; and (g) burning of gas for illuminating purposes between certain hours. In all, thirty-seven rules are laid down pertaining to the conduct of companies engaged in the business of producing or drilling for the products named.

DULUTH, MINN.—June 27

The Railroad Management responsible for shipments of iron ore from the Minnesota ranges continues to develop new means for hampering the shipper, the latest being a proposal to make the operator pay for and maintain the spur tracks leading into his mine, and contracts of a binding nature which will perpetuate this system after the return of the railroads to private ownership have been submitted. Many operators have overcome the stockpile spotting charge of $75 per day, which was put in effect by the Railroad Administration during the last shipping season, by doing the work with their own locomotives and crews, and it is rumored that the objections of the railroad unions to this system have been so strenuous as probably to necessitate a trackage-rental charge so prohibitive as to insure the return to the spotting charge system.

The Oliver Iron Mining Co. is making preparations for the building of a model village at Alice to replace the scattered houses and locations which will have to be moved when operations begin on the removal of the ore now underlying the north end of Hibbing. For this purpose a tract of 40 acres in the village of Alice has been purchased, and work is now going forward on the plotting, grading, and other preliminaries necessary before the building of the houses, which it is announced will be started as soon as the ground is ready. A feature of the new location will be a fine concrete hospital built on the most modern plans possible and which, it is claimed, will be the most complete in Minnesota. It will cover an entire block, be three stories high, and be equipped with a laundry, refrigerating machinery, ventilating machinery, anesthetizing, sterilizing and gynecological rooms, X-ray, and an obstetric section covering the entire third floor.

ISHPEMING, MICH.—June 28

The Michigan State Tax Commission has increased the valuations of many of the mines in both the iron and the copper districts. The Calumet & Hecla Mining Co. is now on the assessment rolls for $3,000,000 more than last year, and some of the largest iron producers have been advanced as much as $1,000,000. The mines of the Gogebic Range are now assessed at about $50,000,000, the largest increases having been made in the case of the Newport Mining Co., the Oliver Iron Mining Co. and the new pit properties near Wakefield. Several of the mines on the Marquette Range were advanced, but some reductions were also made, so the increase is not as great as for some of the other ranges. It was only a few years ago that the tax commission reassessed all of the properties, claiming to place them on a cash-value basis, and it was not expected that any changes would take place this year. The policy of the state to tax all ore reserves has had the effect of slowing up development work, the companies not caring to open ore deposits before they are needed. The Cleveland-Cliffs Iron Co. is the only concern which is doing any great amount of diamond drilling in the Michigan field at present. The company is also working several drills on the Mesabi Range. Ten to twelve drills are being worked regularly by the company on the Marquette Range, but no information is being given out as to the results. It is known that the Cleveland-Cliffs desires to find another mine in the Ishpeming field, as three of the properties now operating there will be worked out within the next three or four years. Ore is not going forward any faster than it was a week ago, there being few shovels attacking the stockpiles. Some properties are not even making shipment of the ore that is now coming to surface, and the outlook for next winter is far from being encouraging. There is certain to be a shortage of stockpile space at the mines unless the movement of ore is much more brisk than it is now.

HOUGHTON, MICH.—June 28

The Situation in the Michigan Copper District is summarized as follows: Seven mines are producing copper as close to normal as their working forces will permit. They are: Quincy, Mohawk, Wolverine, Victoria and the Baltic, Trimountain and Champion mines of the Copper Range company. Eight mines are producing at approximately half of normal. They are: Calumet & Hecla, Isle Royale, Allouez, Centennial, Ahmeek, Osceola Consolidated, Superior, and Mass Consolidated. Fifteen active organizations have their properties closed down: Lake Copper, White Pine, La Salle, Franklin,

New Baltic, New Arcadian, Hancock Consolidated, Winona, White Pine, Cass Copper, Wyandot, South Lake, North Lake, Cherokee and Indiana. Five exploration properties are continuing their development with energy: Seneca, Mayflower-Old Colony, Naumkeag, and Michigan. With reference to the properties that have suspended, it should be understood that mines like the Hancock, Franklin, La Salle, and White Pine are keeping their pumps operating, and could be reopened and become factors in copper output, in a small way, on short notice. Michigan is included in the list of exploration properties. The mine is a regular producer, but has a most important future possibility in an exploratory sense.

More new ground was opened in lower levels of the mines of the copper district during June than in any month for two years. The most noteworthy fact in connection therewith is that the general physical condition is better than average. This applies most importantly to the lower levels of the older mines. It is applicable equally to the newer mines or those working along new lines.

Mines included in the classification of half-normal output have not cut down the total number of men working with drills underground. They have, therefore, a larger number employed in sinking shafts and opening new laterals. This underground preparation for the future places them in position to increase output of copper rock to normal whenever the metal market warrants such action and without the necessity for doubling their underground working forces. Greatest interest centers in the developments at the Seneca and the Michigan properties. The Seneca showing in the Kearsarge amygdaloid is up to reasonable expectations. That was made as certain as anything in copper mining might be made, by reason of the developments in adjoining properties, Ahmeek and Mohawk, and then again by reason of the drill showings when underground tests were conducted.

BIRMINGHAM, ALA.—June 27

Inquiries for Pig Iron are steadily becoming more numerous, a few for 1920 delivery being noted. Most companies, however, are refusing to sell beyond the third quarter of 1919, looking for an advance in prices. Two or three are out of the market for deliveries in the third quarter at present prices, and, owing to the belief that higher prices are to come, no inquiries for 1920 delivery are being considered. The Birmingham district is again shipping iron north, and were it not for the extremely high ocean freight rates the district could secure a large export trade. The Tennessee Coal, Iron & Ry. Co. is preparing to blow in its Alice furnace in the city proper at once; likewise in the near future another furnace at Bessemer, Ala. The feeling in the district is that a decided change for the better has set in.

The demand for steel wire products for future delivery has become so heavy that plants are preparing for long and steady operation. Dealers are said to be taking advantage of the prevailing low prices. The plant of the American Steel & Wire Co. at Fairfield, Ala., has been in steady operation for some time, and, with the exception of repairing to be done in some departments, no shutdown is looked for. The Gulf States Steel Co. will close its Gadsden plant for about three weeks during July in order to put it in the best of condition. This company also expects to start its blast furnace in July. Some repairs now being rushed to completion.

Unionization of mill and furnace workers as well as of those in ore and coal mines and byproduct plants is progressing rapidly with the aid of experienced organizers. The latter declare the workers are eagerly accepting the propaganda of the American Federation of Labor. Mass meetings are to be held throughout the district. One is scheduled for the latter part of June at Ensley, Ala., where the big steel mill of the Tennessee Coal, Iron & Ry. Co. is situated. In reply to inquiries officials refuse to make any statement as to the attitude which would be taken by the companies in regard to the efforts to organize. A shortage of labor in the mining divisions along Red Mountain, first noticed in the middle of June, has increased somewhat during this the last week of June. Some labor is being transported from Bessemer to northern points, but this will not wholly account for the shortage.

VICTORIA, B. C.—June 27

Diamond Drilling is being used to a larger extent in British Columbia in mine development than heretofore. The provincial government is drilling on the Snowstorm group of copper claims in Highland Valley, near Merritt, B. C. The work was started last January, and five borings have been completed. The sixth is now down over 600 ft. Drilling also has started on the property of the Aspen Grove Amalgamated Mines, Ltd., which is under bond to Joseph Errington and associates. This property includes about 75 mineral claims, and the plan is to drill at least 10,000 ft. for the purpose of proving up the orebody. The surface showings indicate an extensive zone, with good values in copper.

The Granby Consolidated Mining, Smelting, and Power Co. closed its Phoenix mines and Grand Forks smeltery on June 10. Trains on the Phoenix branch of the Great Northern Ry. made their last trip on June 13, and now the rails are being removed from the track. For some time the company has been concentrating its efforts at its northern property, at Anyox, and reducing them at Phoenix and Grand Forks, and it was the intention of the owners to close the latter properties at the end of the year. The strike of the coal miners at Fernie, and consequent inability to get coke from there, hastened the closing by six months. The grade of ore at the Phoenix mines has averaged about only 1% of copper and about 60c. in gold and silver for some time. During the last 20 years, 12,814,962 tons of ore has been taken from the Phoenix mines and smelted at Grand Forks, producing 636,291 oz. gold, 4,330,345 oz. silver and 271,079,000 lb. of copper. All the miners and smelter men have been offered work at the Granby company's northern property. During the month of the company's Anyox mines produced 1,267,688 lb. of copper.

In the Portland Canal District, W. R. Tonkin and W. W. Warren, representing United States capital, and John Peterson, of Stewart, B. C., have bonded the North Star, the Van Guard, the Last Chance, and the Second Thought mines, at Alice Arm, Portland Canal district. The total consideration is $550,000. W. Somerville has bonded the Homestake, Meeking & Co. has bonded the Muskateer, and the Taylor Mining Co., a subsidiary of the Taylor Engineering Co., which was incorporated recently to take over the Dolly Varden mine has taken a working option on the Ruby mine, opposite the Dolly Varden, and has started to operate the properties. The Temiskaming Mining Co., of Cobalt, Ontario is negotiating for the purchase of the Moose group.

TORONTO, ONTARIO—June 28

Conferences Between Striking Miners and mine managers of Kirkland Lake have been held without leading to any settlement. The majority of the mining company officials do not expect that any adjustment of the dispute can be effected for some time, and have made their plans for remaining inactive for an indefinite period. One effect of the strike has been to encourage the development of the outlying districts, where a number of the strikers have found employment in doing assessment work on mining claims. Others have gone out as prospectors or obtained work on undeveloped prospects. The Porcupine miners this week presented a wage scale to the operators calling for an increase of 50c. per day all round and asking for an answer by June 28. The minimum asked for is below that demanded by the Kirkland Lake and Cobalt miners, and the attitude of the men is generally conciliatory. They ask for "a reasonable and just discussion of local labor problems, and a peaceful settlement." A factor that is expected soon to cause a subsidence of the strike fever is the large surplus of labor in the Sudbury district, owing to the curtailment of the nickel output, and the reduction of wages in the mining districts of the Western states, which it is anticipated will cause an influx of mine workers into northern Ontario.

THE MINING NEWS

Progress of Mining Operations Condensed and Classified for Easy Reference

ARIZONA

Cochise County

NIGHT HAWK LEASING (Bisbee)—Has purchased new hoisting machinery for property, which will be installed promptly, preparatory to extending shaft from 600 to 800 ft.

Gila County

MIAMI M. & M. (Miami)—Recently closed deal for purchase of milling plant formerly owned by Arizona Butte corporation.

Pima County

LITTLE AJO (Ajo)—Some copper mineralization disclosed by diamond-drill hole at depth of 1,150 ft.

MYERS GROUP (Ajo)—Property adjoining New Cornelia on southeast, may soon be diamond drilled. Investigation of ground by representatives of E. J. Longyear Co., for data in estimating drilling costs, has been made.

PAYMASTER MINE (Twin Buttes)—Preparations being made to open old property again and operate under name of Paymaster Silver & Lead Co.

Pinal County

SILVER BELT (Mayer)—Eight-inch vein cut at 275 ft., carrying 400 oz. silver, 40% lead, within 12-ft. orebody carrying pay ore. Strike is on new ground.

HALF-MOON (Ray)—Property, 12 miles from Florence at Red Hill, being developed by Ray men, headed by Charles Goodman.

Yavapai County

GREEN MONSTER (Jerome)—Secretary G. G. Fuller resigned; succeeded by P. Perkins. Company developing Silver Tip claim.

COLORADO

Boulder County

BOULDER COUNTY TUNNEL (Cardinal)—Development resumed, and force engaged in clearing out tunnel preparatory to active operations. Tunnel is crosscut for 3600 ft., then drift for about 2500 ft. on Boulder County vein. Chicago capitalists interested in new work.

YELLOW PINE (Crisman)—Twenty sets of lessees at work under superintendence of J. W. Pherson. Winze from 6th to 9th level being unwatered, and will probably drain workings of entire property. Installation of larger compressor plant under consideration.

Clear Creek County

BLACK EAGLE (Idaho Springs)—Reopened, and force of six men engaged on development under management of Harry Short.

CROWN POINT (Idaho Springs)—Lessees have opened 30-in. vein of high-grade gold ore west of main shaft.

EDGAR NO. 2 (Idaho Springs)—Lessee Al. Freedman has opened 4 x 4 ft. vein of milling ore in east heading from Big Five tunnel level. Heading being advanced and raise being extended east of old oreshoot for exploration purposes. Six-inch streak of high-grade smelting ore opened 60 ft. east of raise. Miami tunnel level being cleaned out and new track being laid preparatory to resuming development of ground above this level.

LORD BYRON (Idaho Springs)—Mine in Spring Gulch will be taken over by P.

O. Dwyer, of Davenport, Iowa. Planned to develop property to depth of about 900 ft. through Stanley Rood adit level. Crosscut will be driven about 200 ft. to the Byron vein, and thence drift will be advanced on vein for distance of about 2000 ft. to point under Byron shaft. Raise will then be extended about 500 ft. to connect with bottom of shaft.

STANDARD (Idaho Springs)—Lessees have opened small streak of high-grade ore on 400 level of this Fall River property. Ore being shipped in sacks by express to Pueblo smeltery under valuation of $10 per lb.

San Juan County

GOLD BIRD (Silverton)—Development resumed under direction of W. N. Kloster, owner. High-grade gold and silver streak opened.

PARADISE (Silverton)—Crosscut now 200 ft. long and will be advanced 75 ft. to junction of several promising veins. J. W. Esley superintendent.

SILVER LAKE (Silverton)—Secured by John B. Giono and associates under lease from American Smelting & Refining Co. Development will be resumed soon.

San Miguel County

SHIPMENTS OF CONCENTRATES from Telluride during May were as follows: Smuggler Union, 80 cars; Tomboy, 52; total, 132. Twenty cars from Smuggler shipped to Durango, and remainder to Pueblo smelteries.

CALIFORNIA

Eldorado County

STILLWATER GOLD QUARTZ (Omo)—Two hundred feet driven on vein and 6 ft. of quartz exposed.

Fresno County

CHROME PRODUCERS OF FRESNO COUNTY have organized to aid Government in speedy adjustment of claims.

Inyo County

SLATE RANGE MINERALS (P. O. Bakersfield)—Erecting 50-ton mill, combining gravity concentration and flotation, to handle ore averaging $15-$20. Three years' supply blocked out. Eight-mile electric power line installed. Expect to be in operation about July 15. Ore chiefly lead carbonate, with oxides, sulphates and sulphides. High grade shipped to U. S. smelter, Midvale, Utah Property in Slate Range Mountains, about eight miles northeast of Trona, Cal. Number employed 20-40. Production in 1918, 1,331,440 lb. lead, 1,785.85 oz. gold, 64,388.89 oz. silver, and 90,124 lb. copper. Gross receipts 1918 were $142,-821.87. Morris B. Parker, superintendent.

Nevada County

IDAHO MARYLAND (Grass Valley)—Has purchased Eureka claim and is negotiating for purchase of Brunswick group.

Sierra County

EXAMINATION OF ALHAMBRA PROPERTIES in Jim Crow Canyon finished by H. S. Raymond and F. O. Richardson. Sovereign mine now being examined. These properties under option to Gold Exploration Co., of Salt Lake City; also the Comet, latter carrying vein of arsenical sulphides not amenable to ordinary mill processes.

TABLE ROCK MINING CO. has found body of gold-bearing pipe clay overlying gravel in 3,000-ft. tunnel at Howland Flat, near Sierra City. J. H. Hartley in charge.

GIBRALTAR (Downieville)—Two feet per day being made in tunnel by Kieffer brothers.

Siskiyou County

BLUE LEDGE (Hutton)—Shipping three cars weekly of 12 per cent copper ore to Tacoma smeltery, with several thousand tons good ore on dump. Will double shipment while roads are good. Thirty-five-mile haul to shipping point, costing $11 per ton.

Tuolumne County

DREISAM (Tuolumne) Shaft being unwatered by Ripon Mining Co.

IDAHO

Shoshone County

NABOB (Beeler)—Mill of 150 tons' capacity nearing completion. Expected to be running in July. Large amount of lead-silver-zinc ore available. Controlled by Stewart Mining Co.

AJAX (Burke)—Development resumed after suspension of three months. Work transferred from Oom Paul tunnel to Moonlight shaft. Down 200 ft. and drifting west toward common end line with Hercules. Considerable ore continues in drift. Vein supposed to be identical with Hercules. Company controlled by capitalists of Lynn, Mass.

GOLD FLOTATION (Mullan)—Gold Flotation Development Co., which has lease and bond on old Singiser mine in Lehmi County, Idaho, announces mill will be installed within 30 days, and will include crushing plant, tables and flotation cells. Former company discontinued work in 1906, after doing large amount of development, and property is equipped with stamp mill and cyanide plant. Ledge said to be 50 ft. wide, with 3-ft. pay streak. Satisfactory tests made with flotation. Officers and directors: W. H. Havlin, Baltimore, Md., president; Harold Williams, of Mullan, vice-president; H. G. Loop, of Seattle, secretary-treasurer; John Brizel, of Wilmington, Del., and O. W. Lewis, of Wallace.

GIANT LEDGE (Murray)—Large lead-silver oreshoot on 200 and 400 levels. Property originally located and developed for gold.

BULLION (Wallace)—Operations suspended during war. Now has five men drifting into body of 4% copper ore disclosed in shaft above and by diamond drill.

LUCKY SWEDE (Wallace) — Work started in crosscut to promising copper ledge, which will be cut at 1,000-ft. depth. Should reach vein during summer.

NEW MILL UNDER CONSTRUCTION BY SLATE RANGE MINERALS CO., INYO COUNTY, CAL. CUT SHOWS FLOTATION MACHINE ON SKIDS

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Copper production for May was as follows: Ahmeek, 1,117,984 lb.; Allouez, 190,000; C. & H., 3,596,900; Centennial, 92,732; Isle Royale, 790,209; Osceola, 812,497; Superior, 102,386; and White Pine, 94,111.

MICHIGAN COPPER (Rockland)—Copper rock now running 25 lb. to ton. In May output showed 23 lb. to ton. 149,000 lb. being total refined output from 6,230 tons. Company plans to increase force on development work. No construction work now under way. Underground openings going forward on three lodes, the Butler, Ogima, and Evergreen. These all toward location of proposed shaft, east of present shaft.

Gogebic Range

NEWPORT (Ironwood)—Has built four more cottages for miners at North Pabst location. Employees may buy these or other houses from company, paying on instalment plan. In last year homes for salaried men and miners have been built.

PABST (Ironwood)—Haulage-power generating set consisting of tandem-compound Corliss engine and 400-kw. d.-c. generator has been sold and removed from power house. Current for haulage now supplied by rotary converter in pump house on 23rd level, which receives power from turbo-generators in main power house. Company trying out Captain Hoar's mucking machine in 8 by 15-ft. crosscut in granite on 24th level of H shaft. Newport mine has two and ordered another of these machines. Is using them chiefly in ore. Machine driven by air motors, has dipper and swings in horizontal circle, but will operate in 8 by 8-ft. drift.

MONTREAL (Montreal, Wis.)—Exploration of property by diamond drills continuing. Most of holes are some distance north of foot wall in horizons where other mines have recently found ore. This property on Gogebic Range in Wisconsin.

Menominee Range

CARPENTER (Crystal Falls) — Four miners killed on June 20. Bodies recovered.

MINNESOTA

Mesabi Range

AJAX (Biwabik)—Operators announce discovery of vein of high-grade manganese ore 6 ft. wide.

HOBART (Gilbert)—Completion of new spur will permit resumption of shipments July 1. Hanna Ore Mining Co. operators.

ALEXANDRIA (Hibbing)—Big underground property of Hanna Ore Mining Co starts shipment of stockpile.

CYPRUS (Hibbing)—Property, opened by R. M. Sellwood in 1903, makes final shipment. Open-pit scram, total shipments 1,800,000 tons.

WEBB (Hibbing)—Resumes operation of underground portion of mine with full crew day shift only. Shenango Furnace Co operators.

DEAN (Kinney)—Tod-Stambaugh Co. completes churn-drilling campaign. Drilling equipment transferred to Dunwoody, at Chisholm, operated by same company. Dean increases shipments from 80 to 120 cars daily, with announcement of further probable increases.

PILOT (Mountain Iron)—New open-pit property of Hanna Ore Mining Co. made initial shipment June 27. Drainage shaft completed at depth of 103 ft. Complete electrical equipment.

MONTANA

Jefferson County

LEGAL TENDER (Clancy) — Orders placed with hardware and mining machinery department of Anaconda Copper Mining Co. for electric hoist and compressor plant.

Silver Bow County

ANACONDA (Butte)—Shortage of water has compelled Washoe smeltery to shut off treatment of independent copper ores which require concentration. Sinking under way at Orphan Girl and Original shafts. Drifting in ore continues on 1,000 level of Emma mine. Good showing reported at Tropic. Treatment of zinc concentrates from Butte & Superior and Timber Butte Milling Co. resumed. Shaft of Gambrinus, recently acquired, has been abandoned and head-frame removed. Production continues slightly under 60% normal.

ANSELMO MINING (Butte)—Shipments resumed, smelter returns on first six cars showing net value up to $3,000 per car. Succeeding cars running around $1,500 net, value chiefly in gold, silver, and zinc. Property now opened to 800 level through Trifle shaft, and drifting in progress.

BARNES-KING (Butte)—Options being taken on several claims in northern and northwestern part of district. Some preliminary prospecting being done on Little Annie and Georgie properties.

CRYSTAL (Butte)—Drifting on 500 level of North Goldsmith ledge shows ore of medium grade continuing 5 ft. wide.

DAVIS-DALY (Butte)—Steam shovel double former capacity at work removing Colorado mine dump. May returns from development ore show net of over $28,000 despite added cost of removing dump. High-grade zone continues. Silver-zinc shipments from Hibernia approximating carload daily. Sinking of Colorado shaft under way and will be started soon at Hibernia.

ELM ORLU (Butte)—Two high-grade bodies of silver-zinc ore cut on 2,000 level of Rainbow fissure, one 15 ft. wide and other 20, lying on foot and hanging walls. Sinking in progress. Production of zinc ore being increased.

NORTH BUTTE (Butte)—Good ore disclosure reported on 600 level of Speculator. Development progressing, but ore production still curtailed to 25% normal. Sarsfield shaft crosscuts still in country rock.

NEVADA

Washoe County

STANDARD METALS (Reno)—Company operating Peavine mine, near Reno, installing new mill with K. & K. flotation machines, Wilfley tables, Callow tanks. Expected to be in operation within 30 days. Ore chiefly silver, with some copper.

OREGON

Jackson County

RAINIER MERCURY CO. of Tacoma, Wash., operating Utah groups of 35 cinnabar claims north of Gold Hill during last two years, with monthly output of 65 flasks of mercury, has been reorganized. New corporation, known as War Eagle Mining Co., organized at Medford, Ore., with local men at head, is operating mines with present equipment, making developments, and purposes to erect large-capacity furnace for reducing lower-grade ore.

Josephine County

DAILY & CASEY (Selma) — Two prospectors have struck high-grade gold quartz on claims on Briggs Creek near Selma. Rich placer ground near by. District also chrome producer, inaccessible until Government roads were built. Find in Illinois River district.

TEXAS

Brazoria County

WEST COLUMBIA FIELD production for week ended June 19 averaged 34,435 bbl. daily. Producers as follows: Humble Oil & Refining Co., 10,500 bbl.; Gulf Production, 8,300 bbl.; Texas, 8,300 bbl.; Crown Oil, 6,800 bbl.; Sun, 600 bbl.; Hanicker Oil, 35 bbl.

TEXAS CO. (Brazoria)—Good pumper brought in at 2,300 ft. on Masterson & Allen ranch, 11 miles south of Brazoria. Will continue drilling.

Galveston County

HUMBLE OIL & REFINING (Texas City)—Will build 1,200-ft. dock for loading oil from north Texas fields for shipment to Atlantic seaboard refineries. Dredging of channel started; will be 32 ft. deep, to accommodate largest tank steamers. Will be connected with company's 8-in. pipe line from oil fields.

Gonzales County

LARGE ACREAGE NEAR WALDER leased recently, and more ground being taken up; several thousand acres altogether now under lease. Test wells will be sunk soon.

Kleberg County

CONSIDERABLE DRILLING near Kingsville to be done soon. Texas-Kentucky Co. building derrick on land six miles southeast of Kingsville. International Petroleum Co. opened office at Kingsville. Kleberg County Oil & Gas Co., just organized, capital stock $100,000, owns leases on 4,020 acres from six to twelve miles southeast of Kingsville. Some gas seepages found.

Lampasas County

HOWELL WELL NO. 1, on White ranch, shows oil at 1,030 ft. Nelms-Marvin well No. 2, southwest of Lampasas, now drilling in dark gray limestone at 775 ft.

Montgomery County

BLACK HAWK PETROLEUM CO. has Walker No. 3 well down to 4,315 ft., and going deeper.

Orange County

DRILLING BY CHICAGO SYNDICATE will be started soon in Orange County. Large acreage leased. George A. Foreman local manager.

Wichita County

WICHITA FALLS DISTRICT production now about 100,000 bbl. per day, according to producers and pipe line officials. Total capacity of pipe lines in district less than 85,000 bbl. a day. Several lines building. Big companies building more tanks. Federal officials asked to assist in facilitating movement of tank cars to decrease storage.

UTAH

Box Elder County

VIPONT MINING (P. O. Oakley, Idaho)—Proposed to construct modern mill to treat low-grade silver ores, of which there is stated to be good tonnage. Property worked intermittently since '60s, but only high-grade mined. Attempts at concentrating low-grade by old methods unsuccessful. Main tunnel in 1,000 ft., giving depth of 200 ft. Reported force of 50 men working is adding rapidly to low-grade ore on dumps.

Juab County

TINTIC SHIPMENTS week ended June 21 amounted to 110 cars.

CHIEF CONSOLIDATED (Eureka)—Three new pumping units in operation, making possible lift up to 1,250 gal. water per min.

COPPER LEAF (Eureka)—Shaft at this east Tintic property down to 1,200 level, and 100 ft. more of sinking probably to be undertaken. Two shifts working in shaft, and drifting being done on 1,000 level.

EUREKA BULLION (Eureka)—Strike holding out. Raise from 800 level up about 10 ft. and showing 6 ft. of ore. Ore mined also from crosscut in main drift a short distance from raise. Conditions promising. Further sinking to be done, as large bodies are found at depth in this section.

LEHI-TINTIC (Eureka)—Assessment 2c. a share levied to provide funds for new working shaft. Has power connections, and sinking will begin as soon as necessary equipment acquired.

TINTIC PAYMASTER (Eureka)—Consolidation of Paymaster claims with Eureka King effected, stockholders in latter to receive two shares in new company for one of Eureka King. Understood not less than $50,000 worth of development work promised under agreement.

DESERET MOUNTAIN (Tintic Junction)—Probable work will be resumed soon. Opened to depth of 300 ft. Difficulty in getting ore to railroad. Property in west Tintic district.

IMPERIAL LEAD (Tintic Junction)—Some development work being done. Made shipments last year.

Salt Lake County

MICHIGAN-UTAH (Alta)—Shipped six cars week ended June 21. Reported miners still scarce, and that with sufficient force could market 300 or 400 tons weekly.

SELLS (Alta)—Spur 850 ft. long being built to connect with Little Cottonwood Transportation. Shipped 450 wet tons during present season. To increase shipments when spur is in operation.

SOUTH HECLA (Alta)—Shipped about 1,000 tons week ended June 21, over Little Cottonwood Transportation Co.'s road.

MONTANA-BINGHAM (Bingham) — Work resumed on company account after four-months' shutdown; some lessees shipped during this period. Several assessments levied, and last assessment of 2c. a share levied February, 1919; 2,000,000 shares capitalization and 47,000 shares delinquent. This and reductions in salaries and overhead expenses placed company on better foundation. Mayflower drift being worked on level 2,400 ft. from surface on dip of vein and 1,600 ft. below Keystone tunnel of Fortuna.

WOODLAWN MINING (Salt Lake City)—Property at mouth of Cottonwoods has made trial shipments by truck. Stated to have enough ore blocked out for regular shipments.

Summit County

NAILDRIVER (Park Citk)—Work resumed.

SILVER KING COALITION (Park City)—Work resumed under old conditions since calling off of strike. M. J. Dailey, for some time with Cardiff and in early days superintendent of Coalition, is mine manager.

Tooele County

HONORINE MINE (Stockton) — Ore opened in Hercules vein on 600 level by lessees, who are preparing to ship.

Utah County

PACIFIC (American Fork)—High-grade silver ore reported opened in new ground.

WISCONSIN

Zinc-Lead District

KISTLER & STEPHENS (Platteville)—Results of recent drilling on Alderson tract four miles south of Platteville indicate reopening. Property dismantled and abandoned three years ago.

ZINC HILL (Platteville)—Company's "Little Dick" mill, at Cuba City, placed in operation. Milling at "Big Dick" will begin upon completion of shaft now being sunk.

WILSON (Platteville)—Milling plant at Potosi completely destroyed by fire on June 6. Property idle for two years.

CANADA

British Columbia

CONSOLIDATED M. & S. COMPANY has purchased five groups of claims in Sibola country, 20 miles from Sibola Mountain and 100 miles southwest of Grand Trunk Pacific Railway.

ARTHUR E. HEPBURN, of Vancouver, has taken bond on seven claims in Summit camp, Tulameen district. Claims are silver-lead and include Sutter No. 7, Nickel Plate, Huckleberry, Huckleberry Fraction, Sunlight, Sunbeam, and Jumbo.

SKEENA M. & M. has working bond on Victory and Coronado groups, Hudson Bay Mountain, northern British Columbia. Properties silver-lead-zinc. To install 50-ton concentrator and other operating equipment.

NUGGET GOLD (Victoria)—Development tunnel extended 350 ft. and advancing at rate of 200 ft. monthly. When sufficient ore is blocked out Mother Lode mill will be operated. Property on Sheep Creek, near Salmo, B. C.

Manitoba

SILVER DISCOVERY is reported near Mile 235 on Hudson Bay Ry. in The Pas district of northern Manitoba. Find made by Louis Coteau, prospector, and samples exhibited at The Pas.

Ontario

COBALT PROVINCIAL planning to increase capacity of mill to 100 tons at cost of $10,000.

BUFFALO (Cobalt)—Annual report for year ended Apr. 30 showed production of 625,000 oz., a decrease of 140,000 as compared with previous year. Net income for year, $171,238, which brought surplus to $636,139. Ore reserves estimated at $288,700.

FOSTER (Cobalt)—New high-grade vein two inches wide discovered.

MOHAWK (Cobalt) — Work started. Property situated on west side of Mud Lake.

CASTLE (Gowganda)—Shaft down 380 ft., with results stated to be satisfactory.

KIRKLAND LAKE (Kirkland Lake)—Frank L. Culver, president, states mine bins filled with 500 tons of ore and surface dump contains 8,000 tons, with stopes at 300 level also full and smaller quantities at lower stopes. A 15-ft. ore-face shows at 600 level, averaging $55 per ton, and close by is parallel 3-ft. body carrying $28 ore. Underground workings kept pumped out.

YOUNG-DUNCAN (Kirkland Lake)—Property east of Tough-Oakes shows possible extension of same vein system.

MATACHEWAN (Matachewan) — Shaft down 140 ft. and still in ore. Orebody dipping at 70 deg. and expected to leave shaft at depth of about 160 ft. Shaft will be continued to 200 ft. and crosscut started. Stated that assays show average gold content of good milling grade.

DOME EXTENSION (Porcupine)—Annual meeting showed $51,841 cash on hand. Property under option to Dome, and president stated development satisfactory. Large body of ore averaging $5.22 already developed.

INSPIRATION (Porcupine) — Diamond drilling begun.

MEXICO

Baja California

COMPAGNIE DU BOLEO (Santa Rosalia)—Copper production for May was 1,322,720 lb.

Sonora

SANTA LUCIA (Nacozari)—Syndicate headed by D. J. O'Rourke, of Potter, Jarvis & O'Rourke Construction Co., has perfected 60-day option upon Santa Lucia mine. Careful investigation of property now being made. Ore contains silver, copper and lead.

BELGIAN CONGO

UNION MINIERE DU HAUT KATANGA (Elisabethtown)—May production of copper was 2,094,370 lb.; April, 4,298,970 lb.

BURMA

BAWDWIN MINES (Bawdwin)—Lead production for May, 1,976 tons gross, from 5,088 tons of lead-bearing material (including secondaries); refined lead production 1,587 tons; refined silver production approximately 180,371 oz.

THE MARKET REPORT

Daily and Weekly Metal and Mineral Prices,
Metal Market Conditions, Average
Monthly Prices, Stock Quotations

Silver and Sterling Exchange

June	Sterling Exchange	Silver New York, Cents	Silver London, Pence	June-July	Sterling Exchange	Silver New York, Cents	Silver London, Pence
26	4.5800	1.09½	53¾	30	4.5900	1.08¼	53
27	4.5900	1.08¾	53¼	1	4.5800	1.07⅞	..
28	4.5938	1.08½	53⅛	2	4.5538	1.07½	53

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Daily Prices of Metals in New York

June-July	Copper Electrolytic	Tin Spot	Lead N. Y.	Lead St. L.	Zinc St. L.
26	18.35	68	5.35@5.40	5.15	6.95@7.00
27	18.50	68	5.35@5.40	5.15	6.95@7.00
28	18.60	68	5.35@5.40	5.15	6.95@7.00
30	18.70@18.85	68	5.35@5.40	5.15	7.00
1	19.00@19.10	68	5.35@5.40	5.15	7.00
2	19.10	68	5.35@5.40	5.15	7.00

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb above St. Louis. Tin is quoted on the basis of American tin, 99 per cent grade.

London

June-July	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot	Zinc 3 M
26	86½	88½	90	239½	235½	22⅛	22¼	38¼	38¾
27	87⅞	88½	91	238	235½	22⅛	22¼	38½	39
28	...	...	...	...	...	...	...	...	...
30	87	88¼	91	238½	236	22⅜	22½	38¾	39¼
1	86½	88½	91	240	236½	22¼	22⅜	39	39⅜
2	89	90	92	240	238½	22½	22¾	39½	40

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—July 2, 1919

The main features this week were a further advance in copper, which crossed 19c. in its upward movement, and the resumption of free trading in tin on a fairly active scale.

Pacific freights remain unchanged at $14 from San Francisco to Hongkong and Kobe. Transatlantic freights remain unchanged.

The price for three-months tin, at London, on June 25, was given incorrectly in the "Journal" of June 28. The correct price was £238.

Copper—The conditions we reported last week continued, i.e., the market remained wholly in the hands of the producers, who made the consummation of relatively small business the basis for advancing prices further, and immediately obtained what they asked. On Thursday the market was firmly established at 18½c., delivered, and before the end of Friday no copper was to be had for less than 18¾c., delivered.

On Saturday the market was firmly established at 18¾c., delivered. During these days a pretty good business was done. A noteworthy feature was the buying by brass-makers. With Monday, producers advanced their prices to 19c., delivered, and on Tuesday a further advance to 19¼c. was made. A rather fair business was done on Monday, but on Tuesday and Wednesday transactions were light.

The total of domestic business done during this week was only moderate, but the sentiment among the buyers is such that producers are able to advance prices and get them on relatively small business. No attention is paid to the statistical position, but a good deal is focussed on the labor situation.

The Japanese were again considerable buyers of copper this week, making purchases through the Export Association. Nobody knows just what is at the bottom of the Japanese demand.

Copper Sheets—The base price of copper sheets is 28½c. per lb. Market strong. Copper wire is quoted at 22c. in carload lots, f.o.b. mill. Market strong.

Tin and Lead

Tin—Business amounting to several hundred tons was transacted during the week, mainly in the reselling of surplus material. Producers did not sell much. There was substantially no change in prices from those which prevailed at the close of the previous week. The market is still more or less in a daze and has not yet found itself, many consumers who are potential sellers apparently not yet having made up their minds what to do. At the close high-grade tin, including Straits, Banka, and American electrolytic, was quoted at 70c., and tin of 99 per cent grade was at 68c. July-August shipments from the Straits and July shipments from Banka were quoted at 50½c., c.i.f. Lamb & Flagg, July shipment, 51½c. Lamb & Flag, 99 per cent grade, July shipment, 51¼c.

Lead—A rather large business was transacted during the week, especially on Friday. Following that the market became rather dull. The prices were cut a little in order to effect business. There was gossip about bonded lead being sold at 4¼c., which would give a price of 5c., or only a trifle more for domestic consumption. A small quantity was bought on that basis, but this was apparently lead smelted in this country from foreign ore, the supply of which is not large. Mexican producers were able to sell rather freely, at relatively good prices, to France and Japan, and so long as they have a fair foreign outlet they will not be disposed to think of entering their product for domestic consumption.

inc

Zinc—A rather large business was done during the week, much of which was apparently of speculative character. The market having touched 7c., some interests were evidently minded to realize, and sales were made as low as 6.95c. However, the market exhibited a good deal of resiliency, and quickly returned to a firm basis of 7c. The advance in spelter in London, which today touched £40 for futures, is reflected here. for spelter could theoretically be sold for shipment to England via Galveston, on terms netting 7@7.05c., f.o.b., works in Oklahoma. However, the

sharp fluctuations in sterling exchange make all calculations uncertain.

Zinc Sheets—The quoted price of zinc sheets is $10 per 100 pounds.

Other Metals

Aluminum—Virgin metal quoted at 32@33c. per lb. Market quiet.

Antimony—Unchanged at 8⅞@8½c. for spot. Scarcely any offerings of futures are made.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.50 per lb. in lots of 500 pounds. For lots under 200 pounds, $1.75 per lb.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Shortage in supplies here continues, but there was no further advance in price this week. Californian is quoted at $95, and Mexican at $92. San Francisco telegraphs $92, firm.

Silver and Platinum

Silver—The London price has shown a downward tendency. Owing to the weakness of China exchange, there having been a decline both in Shanghai and Hongkong, the offerings on the London market have been larger. Shipments of gold to China may have occasioned the decrease in demand for silver in that quarter.

Mexican dollars at New York: June 26, 84⅜; June 27, 83¾; June 28, 83½; June 30, 82¾; July 1, 82½; July 2, 82½.

Platinum—In very strong demand, but as yet no further advance in price. We quote refined ingot at $105@$107½. A lot of crude platinum sold this week fetched $105.50, which would indicate a price of $107.50 for refined ingot. There were several bidders for this lot.

Philipp Bros., metal and ore dealers, of New York, inform us that Derby & Co., Ltd., of England, have consigned to them a parcel of platinum per the dirigible "R-34."

Zinc and Lead Ore Markets

Joplin, Mo., June 26—Zinc blende, per ton, high, $47.50; basis 60 per cent zinc, premium, $46; Prime Western, $45; sludge and flotation, $42.50@40; calamine, basis 40 per cent zinc, $28@25. Average settling prices: Blende, $42.71; calamine, $26.36; all zinc ores, $42.27.

Lead, high, $63.30; basis 80 per cent lead, $60; average settling price, all grades of lead, $60.83 per ton.

Shipments the week: Blende, 8,467; calamine, 236; lead, 1,303 tons. Value, all ores the week, $447,130.

Shipments six months: Blende, 271,161; calamine, 7,240; lead, 38,289 tons. Value, all ores six months, $13,234,910.

Sellers are producing so lightly this week that no offer under $45 basis would be accepted. Buyers finally met this demand, and a considerable tonnage was contracted on the higher price level. Owing to miners and teamsters leaving for the harvest, estimates are offered of a reduction of 20 to 40 per cent in the production this week. Perhaps 25 per cent is a conservative estimate. Few mills are idle, but none are milling over 75 per cent of capacity.

Platteville, Wis., June 28—Blende, basis 60 per cent zinc, $45 base for premium grade, and $42.50 base for high-lead or Prime Western grade. Lead ore, basis 80 per cent lead, $60 base for top grade and $59 base for second grade. Shipments reported for the week are 1,905 tons blende, 284 tons galena, and 396 tons sulphur ore. For the year to date the totals are 50,224 tons blende, 2,611 tons lead, and 7,144 tons sulphur ore. Shipments for the first six months of 1919 compared with the corresponding period of 1918 show decreases for all ores as follows: Blende, 16,210 tons; galena, 983 tons; sulphur ore, 19,457 tons. During the week 2,937 tons blende was shipped to separating plants.

Other Ores and Minerals

Chrome Ore—This ore is offered abroad, but high freight rates prevent the consummation of business. It is thought that Canada may become a larger producer of chrome ore.

Manganese Ore—Charles Hardy reports that the first shipment of Caucasian ore has been made, but American buyers being skeptical of it, the material was diverted to Liverpool, where it was due to arrive on or about July 3.

Molybdenum Ore—Unchanged at 75@85c. per lb., but this quotation is merely nominal, there being scarcely any inquiry for the ore.

Tungsten Ore—Considerable business was reported this week, Chinese ore selling at $7.25@$7.50. Shipments from China were sold at $6.75. High-grade ore is still held at $10 and upward, but no business was reported.

Nitrates—The market is quoted at $3@$3.25 for carload lots, with some spot supply reported available in this country. It is said there have been practically few or no transactions done with Chilean producers recently, importers in this country awaiting easier prices.

Pyrites—Spanish pyrites is quoted at 19c. per unit for furnace ore, c.i.f., New York or other Atlantic port. Market slow and unsettled.

Iron Trade Review

New York, July 2,

June pig-iron output, according to *The Iron Age*, shows definitely the turn in the industry. For the thirty days the total was 2,114,863 gross tons, or 70,495 tons a day, against 2,108,056 tons in May, or 68,002 tons a day. Seventeen furnaces blew in and twelve blew out last month, a gain of five, and estimated capacity active on July 1 was 71,700 tons a day for 200 furnaces, as compared with 68,600 tons a day for 195 furnaces on June 1.

The gain in output last month was the first check to a steady decline in the daily average from the high point reached in September, 1918, at 113,942 tons. From 372 furnaces in blast Sept. 1, last year, the shrinkage was 177 in nine months to 195 on June 1.

Pittsburgh—July 1

The steel market has continued to gain steadily. The advent of the midsummer period does not appear to have any effect whatever upon the activity, and the common opinion now is that the improvement will not be interrupted by the season or anything else. The prospective signing of the peace treaty doubtless had a favorable effect, but results from the actual signing are yet to be seen, and these will probably be observed during the next few weeks in favorable action by directorates, executives, and general investors upon various construction projects that have been held in abeyance until the consummation of this important event.

Steel-mill operations, which dropped from 65 per cent to 54 per cent from April to May, as monthly averages, and probably to about 50 per cent at the middle of May, were approximately 65 per cent of capacity last week, and are showing further increasing tendency, though this week the holiday interferes somewhat. Many mills are operating at a general average of 75 per cent, and some are doing better than that, and many departments are running full. The general average is pulled down by the light operation of rail, plate and structural mills.

Even in conservative quarters the prediction is now ventured that the steel industry will be operating substantially at capacity next September, as a result of continuance of the improvement in steel demand that has been so constant for the last six or seven weeks. Such predictions, however, do not necessarily mean that the full ingot capacity will be engaged. The percentages named above are computed on ingot capacity, which is taken at 49,000,000 tons a year, against about 35,000,000 tons in 1914, showing a 40 per cent increase. There has not been a commensurate increase in finishing capacity for any important product except plates, and the majority of finishing departments could run full without using all the raw steel that could be made. Prior to the war, the supply of ingots would run short before all finishing departments attained full rates.

The general character of demand can be described in fewer words by mentioning the slack commodities than those that show full activity. The least demand is for rails, and plates, structural shapes, and butt-weld pipe follow in sequence. Even tin-plate demand has increased and is producing operations near to capacity. Delivery promises on lap-weld pipe, because of continued heavy demand for oil-country goods, are lengthening. Demand for shapes is steadily improving. Fabricated-steel lettings doubled from April to May, to 49 per cent of the shop capacity, and June is expected to show a marked additional improvement.

Predictions of prospective advances in steel prices, recently floating about promiscuously, are now much less common, probably through the Steel Corporation quietly allowing it to become known that it has definitely adopted the policy that there should be no steel price advances this year. It is understood the Steel Corporation has let it be known it would refuse to be stampeded, even should the independents all advance prices, and with such warning the independents are unlikely to make any attempts.

Pig Iron—The market has become quiet, but at the same time it shows a stronger undertone, the active furnaces being well sold up for a few months by reason of the recent activity, and the idle furnaces are unlikely to consider blowing in until there is fresh evidence of demand. The Valley market is now firm at Mar. 21 prices, and concessions by other furnaces for Pittsburgh delivery have become uncommon. We quote Valley prices at $27.95 for bessemer, $25.75 for basic, $26.75 for foundry, and $25.75 for forge, with $1.40 freight to Pittsburgh. W. P. Snyder & Co. report computation of average prices involved in sales by Valley furnaces during June at $27.95 for bessemer and $25.75 for basic, the averages being the same as for the two months preceding, and being the regularly recognized quotations. Valley foundry was quotable at $26.75 throughout the month.

Steel—Billets, slabs, and rods continue quiet. Sheet bars are in active demand, chiefly because sheet and tin mills send specifications weekly to their regular sources of supply without price negotiation, the market being firm. We continue to quote: Billets, $38.50; slabs, $41; sheet bars, $42; rods, $52.

Ferromanganese—Domestic producers made sales of a few thousand tons of 80 per cent ferromanganese when they reduced prices to $110, apparently fearing that English producers would cut their price of $125, delivered, or $121, c.i.f., and take prospective business. Some makers state they have returned to their former $125 quotation, but desirable orders could probably be placed at the same price as recently. We quote domestic ferromanganese at $110 @$125, delivered, and English at $125, delivered, with spiegeleisen practically nominal at about $30@$33 for 18 per cent delivered.

Coke—Nearly all the contracting for second half has now been done, furnace coke going generally at 6¼ to 1, against basic pig iron at Valley furnaces, and foundry at $5@$5.50, depending on brand. As usual, spot coke is stiffer, on account of the impending holiday, furnace having brought $4.25 even last Saturday. Next week the usual reaction will probably occur. Illustrating the situation, one producer of a favorite brand is today holding spot at $4.25, but would sell over July at $4. Prompt foundry may be quoted at $4.50@$5 as formerly, per net ton at ovens.

MONTHLY AVERAGE PRICES OF METALS

Silver

	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	101.125	36.963	47.215	48.886
May	74.745	99.505	107.135	37.940	48.980	52.104
June	76.971	99.500	110.430	39.065	48.875	53.896
July	79.010	99.625	.....	40.110	48.813	.....
Aug.	85.407	100.292	.....	43.418	49.077	.....
Sept.	100.740	101.125	.....	50.920	49.500	.....
Oct.	87.332	101.125	.....	44.324	49.500	.....
Nov.	85.891	101.125	.....	43.584	48.969	.....
Dec.	85.960	101.125	.....	43.052	48.492	.....
Year	81.417	96.772	.....	40.851	47.516	.....

New York quotations cents per ounce troy, 999 fine London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	15.246	110.000	77.300	125.000	82.200
May	23.500	15.864	110.000	77.767	125.000	81.227
June	23.500	17.610	110.000	83.062	125.000	85.900
July	25.904	.....	119.913	.....	134.913	.....
Aug.	26.000	.....	122.000	.....	137.000	.....
Sept.	26.000	.....	122.000	.....	137.000	.....
Oct.	26.000	.....	122.000	.....	137.000	.....
Nov.	26.000	.....	122.000	.....	137.000	.....
Dec.	(a)	.....	118.447	.....	133.167	.....
Year	24.628	.....	115.530	.....	130.507	.....

(a) No Market.

Tin

	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	72.500	329.905	225.275
May	(a)	72.500	364.217	234.398
June	(a)	71.240	331.925	238.263
July	(a)	.....	360.347	.....
August	(a)	.....	380.900	.....
September	(a)	.....	343.905	.....
October	(a)	.....	335.543	.....
November	(a)	.....	323.550	.....
December	(a)	.....	267.736	.....
Av. year	(a)	.....	330.138	.....

(a) No average computed.

Lead

	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	4.982	6.701	4.722	29.00	24.888
May	6.818	5.018	6.704	4.773	29.00	23.852
June	7.611	5.340	7.511	5.070	29.00	22.544
July	8.033	.....	7.750	.....	29.00	.....
August	8.050	.....	7.750	.....	29.00	.....
September	8.050	.....	7.750	.....	29.00	.....
October	8.050	.....	7.750	.....	29.00	.....
November	8.050	.....	7.750	.....	31.20	.....
December	6.564	.....	6.324	.....	40.00	.....
Year	7.413	.....	7.222	.....	30.10	.....

Zinc

	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	7.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890	6.465	6.715	6.114	54.000	36.118
May	7.314	6.429	7.114	6.079	54.000	35.477
June	8.02	6.901	7.791	6.551	54.000	36.763
July	8.688	.....	8.338	.....	54.000	.....
August	8.985	.....	8.635	.....	54.000	.....
September	9.442	.....	9.092	.....	54.000	.....
October	8.801	.....	8.451	.....	54.000	.....
November	8.491	.....	8.141	.....	54.100	.....
December	8.163	.....	7.813	.....	56.050	.....
Year	8.159	.....	7.890	.....	54.180	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pittsburgh

	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.54	33.95	31.40	33.95	29.12
April	36.15	29.35	32.95	27.15	33.95	28.15
May	36.20	29.35	33.00	27.15	34.00	28.15
June	36.36	29.35	33.16	27.15	34.16	28.15
July	36.60	.....	33.40	.....	34.40	.....
August	36.60	.....	33.40	.....	34.40	.....
September	36.60	.....	33.40	.....	34.40	.....
October	36.60	.....	34.40	.....	35.40	.....
November	36.60	.....	34.40	.....	35.40	.....
December	36.60	.....	34.40	.....	35.40	.....
Year	$36.67	.....	$33.70	.....	$34.45	.....

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. Exch.†	July 1
Alaska Gold M.	3⅛
Alaska Juneau	2
Am.Sm.&Ref.,com.	84⅛
Am.Sm.&Ref.,pf.	109
Am.Sm.Sec., pf., A.	92
Am. Zinc	23
Am. Zinc, pf.	60½
Anaconda	73⅛
Batopilas Min.	1⅛
Bethlehem Steel	87
Butte & Superior	30⅛
Butte Cop. & Zinc	13
Cerro de Pasco	63⅛
Chile Cop.	28⅛
Chino	47
Colo. Fuel & Iron	49⅛
Crucible Steel	97⅛
Crucible Steel, pf.	101⅛
Dome Mines	14⅛
Federal M. & S.	14⅛
Federal M. & S., pf.	42⅛
Great Nor., ore ctf.	44⅛
Greene Cananea	46⅛
Gulf States Steel	68
Homestake	85½
Inspiration Con.	65⅛
International Nickel	32⅛
Kennecott	40⅛
Lackawanna Steel	85⅛
Mexican Petrol.	184
Miami Copper	38⅛
Nat'l Lead, com.	80⅛
National Lead, pf.	116
Nev. Consol.	19⅛
Ontario Min.	8⅛
Ray Con.	24⅛
Republic I.&S.,com.	93⅛
Republic I.&S., pf.	104⅛
St. Joseph Lead	14⅛
Sloss-Sheffield	72⅛
Tennessee C. & C.	13⅛
U. S. Steel, com.	109⅛
U. S. Steel, pf.	116
Utah Copper	89⅛
Va. Iron C. & C.	65
Worthington Pump	80⅛

Boston Curb *	July 1
Boston Ely	1⅛
Boston & Mont.	.84
Butte & Lon'n Dev.	.21
Calaveras	1⅛
Chief Con.	2⅛
Contact	‡.05
Cortez	.12
Crown Reserve	.30
Crystal Cop.	.12
Eagle & Blue Bell	2⅛
First Nat. Cop.	‡1⅛
Gadsden Cop.	‡3⅛
Houghton Copper	1
Intermountain	‡.05
Iron Blossom	.30
Iron Cap	10⅛
Majestic	.22
Mexican Metals	.14
Mines of America	‡.05
Mojave Tungsten	.15
Nat. Zinc & Lead	.09
Nevada-Douglas	.17
New Baltic	.2
Oneco	.75
Pacific Mines	‡.35
Rex Cons.	.12
Yukon Gold	.87

San Fran.*	June 24
Alta	‡.08
Andes	.20
Best & Belcher	.13
Caledonia	.15
Challenge Con.	‡.03
Confidence	‡.25
Con. Virginia	1.35
Gould & Curry	.05
Hale & Norcross	.19
Jacket-Cr. Pt.	.03
Mexican	.35
Occidental	‡.40
Ophir	1.00
Overman	‡.10
Savage	.15
Sierra Nevada	.05
Union Con.	.17
Utah Con.	‡.04
Belmont	3.50
Jim Butler	.33
MacNamara	.76
Midway	.37
Mcnt.-Tonopah	‡.20
North Star	.09
Rescue Eula	.20
West End Con.	1.70
Atlanta	.04
Booth	.09
Comb. Frac.	.04
Florence	.51
Jumbo Extension	.11
Kewanas	.03
Nevada Hills	.04
Nevada Packard	.23
Round Mountain	.30
Silver Pick	.06
White Caps	.18

Colo. Springs*	July 1
Cresson Con.	3.75
Doctor Jack Pot	.03
Elkton Con.	.04⅛
El Paso	.14
Gold Sovereign	‡.02
Golden Cycle	1.64
Granite	.12⅛
Isabella	.04⅛
Mary McKinney	.07
Portland	.97
United Gold M.	‡.16⅛
Vindicator	.49

Boston Exch.†	July 1
Adventure	‡1⅛
Ahmeek	81
Algomah	‡.80
Allouez	‡41
Ariz. Com.	14⅛
Arnold	‡.20
Bingham Mines	9½
Bonanza	‡.20
Butte-Balaklava	‡.38
Calumet & Ariz.	69
Calumet & Hecla	410
Carson Hill	15⅛
Centennial	‡16
Copper Range	52⅛
Daly West	‡2⅛
Davis-Daly	8
East Butte	15⅛
Franklin	‡4
Granby	67
Hancock	‡6
Hedley	‡12
Helvetia	5
Indiana	‡1⅛
Isle Royale	37⅛
Keweenaw	1
Lake	‡4⅛
La Salle	‡3⅛
Mason Valley	‡3⅛
Mass	7
Mayflower	11⅛
Michigan	6⅛
Mohawk	69
New Arcadian	‡4
New Cornelia	24⅛
New Idria	9
Nipissing	11⅛
North Butte	13
North Lake	‡1⅛
Ojibway	‡2⅛
Old Dominion	42
Osceola	57⅛
Quincy	72
St. Mary's M. L.	‡59
Santa Fe	‡.35
Seneca	‡24
Shannon	3⅛
Shattuck-Ariz.	‡15⅛
So. Lake	‡3
So. Utah	.23
Superior	8
Superior & Bost.	3⅛
Trinity	‡3⅛
Tuolumne	‡1⅛
U. S. Smelting	69
U. S. Smelting, pf.	49⅛
Utah Apex	3
Utah Con.	10⅛
Utah Metal	3⅛
Victoria	‡3⅛
Winona	1⅛
Wolverine	‡21

N. Y. Curb†	July 1
Alaska B. C. Met.	⅛
Alaska Mines	.75
Big Ledge	⅛
Butte & N. Y.	⅛
Butte Detroit	‡.03
Caledonia	.41
Calumet & Jerome	⅛
Can. Cop. Corpn	1⅛
Cashboy	.08⅛
Con. Ariz. Sm.	⅛
Con. Coppermines	‡7
El Salvador	3⅛
Goldfield Con.	.16
Goldfield Merger	‡.04
Hecla Min.	5⅛
Howe Sound	‡4⅛
Louisiana	⅛
Magma	‡37⅛
Marsh	.09
McKinley-Dar-Sa.	.62
Milford	‡.75
Mother Lode	‡.43
Nixon Nevada	‡.23
Ohio Cop.	⅛
Rawley	‡2⅛
Ray Hercules	2⅛
Richmond	‡.50
Rochester Mines	‡.19
So. Am G. & P.	11⅛
Standard S. L.	⅛
Stewart	.22
Success	.04⅛
Tonopah	‡3⅛
Tonopah Divide	8
Tonopah Ex.	‡2⅛
Tribullion	‡.25
Troy Arizona	‡.10
United Eastern	4⅛
United Verde Ext.	‡40⅛
United Zinc	‡.25
Utica Mines	‡.08

Toronto*	July 1
Adanac	.15
Bailey	.03
Beaver Con.	.42
Conlagas	2.50
Hargraves	.02
Kerr Lake	5.75
La Rose	43⅛
Lake Shore	‡1.00
Min. Corp. of Can.	‡2.50
Peterson Lake	.11
Teck-Hughes	.20
Temiskaming	.36
Trethewey	.36
Wettlaufer-Lor.	.04
Davidson	‡.08
Dome Exten.	.30
Dome Lake	.12
Hollinger	6.50
McIntyre	1.75
Newray	.2⅛
Porcu. Crown	.27
Vipond	.20
West Dome	.13

*Bid prices. † Closing prices. ‡ Last quotations.

THE MINING INDEX

Listing Special Articles of Interest
and Value to the Miner
and Metallurgist

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105—POWER—Economy of Certain Arizona Steam-Electric Power Plants Using Oil Fuel. C. R. Weymouth. (Advance copy, A. S. M. E., June 16, 1919; 23 pp.) Refers to plants of Inspiration, New Cornelia, and Arizona Power companies.

196—QUEENSLAND—Resources of the Cloncurry Copper Field, North Queensland. S. Harris. (Reprinted from Chem. Eng. and Min. Rev., Nov., Dec., 1918, and Jan., 1919; 12¾ pp., illus.)

107—SOUTHWEST—Notes on Certain Ore Deposits of the Southwest. (Bull. A. I. M. E., Feb., 1919; 3 pp.) Discussion of paper by W. Tovote, previously indexed.

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GOLD AND SILVER

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